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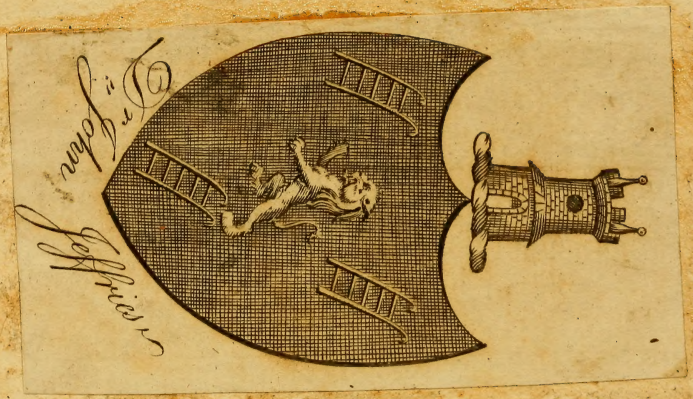

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THE COMMENTARIES UPON THE APHORISMS OF Dr. HERMAN BOERHAAVE,

The late Learned Profeſſor of Phyſick in the Univerſity of LEYDEN,

CONCERNING

The KNOWLEDGE and CURE of the ſeveral DISEASES incident to HUMAN BODIES.

By GERARD VAN SWIETEN, M. D.

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VOL. III.

Of Wounds in the Thorax and Abdomen; Contuſions; Fractures; Luxations; Inflammations; Abſceſſes and Fiſtulæ.

Tranſlated into ENGLISH.

LONDON:
Printed for JOHN and PAUL KNAPTON, at the Crown in Ludgate-Street. MDCCLIV.

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THE

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COMMENTARIES

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OF

HERMAN BOERHAAVE,

CONCERNING THE

KNOWLEDGE and CURE of DISEASES.

Of Wounds in the THORAX.

SECT. CCXCVII.

WOUNDS inflicted in the thorax, are known to have not penetrated its cavity by inſpection, by the probe, by no air being diſcharged by any means, by the return of liquors injected warm, by placing the body in the ſame poſture as when it received the wound, and by certain ſigns that the lungs adhere to that part of the pleura which the wound has penetrated.

We call the thorax that part of the trunk of the body, which is terminated before by the ſternum, behind by the twelve vertebræ of the back, on the ſides by the arched ribs, above by the two ſuperior ribs, and below by the diaphragm, which ſeparates it from

the cavity of the abdomen. But as the diaphragm is placed obliquely, and forms a kind of arched roof, in such a manner that its fore-part rises much higher than its back-part, which is inserted lower, it is thence evident that the cavity of the thorax is much larger behind than before. Internally this whole cavity is lined on all sides with a very smooth membrane termed the pleura, which in a manner forms two hollow bladders, (as we explained it in § 170. numb. 4.) attached close to each other near the sternum, so as to partition the cavity of the thorax into two; and betwixt the meeting of these two pleuræ, is placed the pericardium with its inclosed heart, making the third chamber or cavity of the thorax.

Now in all wounds of the thorax, the first enquiry ought to be, whether they have penetrated its cavity or not? for when the wounding instrument has perforated the membrane of the pleura, or the pericardium, the wound may be then said to have penetrated the cavity of the thorax, otherwise not. But a wound inflicted in the thorax may be very dangerous, and injure a great many parts without entering its cavity: for the pleura of each side having reached the sides of the column of the vertebræ, recede from the ends of the ribs, and rising up leave a considerable space, which is occupied by the celluler membrane, through which the œsophagus, aorta, thoracic duct, *&c.* pass. Therefore all the parts here placed may be injured, though the wound does not penetrate into the cavity of the thorax; but this will easily appear to be very seldom the case, because these parts are defended pretty securely by the column of the vertebræ behind them. But that a wound has not entered the cavity of the thorax, but only injured the external parts, may be known by the following signs:

By inspection.] That is, when the wound is sufficiently large, and runs in a straight course.

By the probe.] Which being formed either of lead or soft silver, is to be introduced through the apertures

tures of the wound, without any force or violence. But it is easily apparent, that a change in the situation of the body, or the fat, concreted blood, &c. stopping up the wound, may easily obstruct the passage of the probe, and afford a resistance to the touch, notwithstanding the wound penetrates into the cavity of the thorax.

No air being discharged by any means.] It was shown in the comment on § 170. numb. 4, that the surface of the lungs is always exactly contiguous to the pleura, while the cavity of the thorax remains entire, and that no air at all is contained betwixt the lungs and the pleura; but when a wounding instrument has perforated the pleura, the air may then enter and compress that side of the lungs, and thus the space before filled by the lungs, will now be filled with external air. But this air being rarified by the heat of the parts, will in part escape through the wound, and more air will enter again; so that the air will continually enter and return by the wound, especially if the perforation of the pleura is not very large; for then the lungs may be in some degree dilated by the air entering through the glottis, as we explained it more at large in the place above cited. In wounds of the thorax therefore, a skilful surgeon always enquires whether the air rushes impetuously through the wound, and this chiefly in the following manner. After the surgeon has compressed or closed the lips of the wound together with his thumb or fingers, so that no air can enter or return by it, he then orders the patient to inspire as much air as he well can, and to retain the inspired air in his lungs, by shutting the larynx; and then, before the patient breathes out the air, he places a wax candle opposite the wound, and suddenly opens its lips; if now any air entered into the cavity of the thorax, it will be forcibly blown out through the wound, so as to move the flame of the wax candle. For thus the air entered into the cavity of the thorax by the wound, will be

rarified by the heat of the body; and the lungs of the ſame ſide being alſo dilated by a violent inſpiration, and the inſpired air rarified by its retention and cloſing of the glottis, this will expand the lungs, ſo as to increaſe the compreſſure of the air contained in the cavity of the thorax, and which will therefore ruſh out impetuouſly and with a noiſe, ſo ſoon as a free paſſage is given to it by opening the lips of the wound. Now it is evident, that if the air thus ruſhes through the wound, it muſt certainly penetrate into the cavity of the thorax; but then the thorax may be perforated, and no air be thus diſcharged, becauſe by changing the poſture of the body from that in which it received the wound, the fat or fleſh may occlude the perforation; ſo that though a little air might have been admitted into the thorax, yet it cannot eaſily eſcape again for the ſame reaſon. This holds true, more eſpecially when the wound perforating the thorax is ſmall or narrow: and from hence we are therefore enabled to judge how far this ſign may be relied upon with certainty.

By the return of warm liquors injected.] This ſeems to be of all the moſt certain and ſafe method of determining the queſtion. For the ſearch by the probe may often be fallacious, ſince changing the poſture of the body may in a fat perſon occlude the perforation by the cellular membrane, which will obſtruct the probe from reaching to the bottom of the wound. And ſometimes the probe may enter near its whole length into the wound, without entering the cavity of the thorax; the wounding inſtrument having ſlid over the ribs into the fat, as we are taught by chirurgical obſervations. A ſtudent was ſo wounded in the right ſide of the thorax by a ſword, in ſingle combat, that the wound inflicted in the ſide as the body preſented obliquely, came out on the left ſide of the thorax, without at all entering its cavity, becauſe the ſword ſlid over the ribs. Warm water is to be injected by a ſyringe through the mouth of the wound

wound with a moderate force: and if a conſiderable quantity of water may be thus injected without any reſiſtance or apparent tumour in the cellular membrane, we then know that the water paſſes by the wound into the cavity of the thorax; but if a conſiderable reſiſtance is immediately felt, and the injected water returns by the mouth of the wound, this ſhews the contrary. Nor is any injury to be feared from this tryal, even though the warm water injected ſhould paſs into the cavity of the thorax; for it may be eaſily diſcharged again from thence by a convenient poſture of the body, and by the means we ſhall hereafter deſcribe in § 303: or even if it is left there, it will be abſorbed by the bibulous veins opening throughout the whole ſurface of the lungs and pleura; and that liquors contained in the cavity of the thorax may be thus carried off, we are taught by frequent experience. In an empyema, the matter has been found to be this way abſorbed and diſcharged with the ſaliva, urine, or by the inteſtines; and the ſame matter entering by the veins, and mixing with the blood, has been often tranſlated and ſettled upon divers other parts of the body. And thus Parey was ſurprized, after injecting a little liquor into the thorax to deterge and cleanſe the cavity, that the wounded perſon ſhould perceive an extreme bitter taſte, and have an inclination to vomit [a]; and therefore he abſtained from his medicines.

Poſture of the body, *&c.*] What conſiderable uſe a knowledge of the poſture of the patient's body when wounded may be of, towards determining the nature of the wound, and preſaging the conſequent maladies to be thence feared, we have already declared in the comment on § 168. numb. 1. For frequently it is altogether impoſſible to diſcover the courſe of the wounding inſtrument betwixt the parts of the body, unleſs the wounded patient is placed in the ſame poſture as when he received the wound. For the various actions of the muſcles may wonder-

[a] Les Oeuvres d'Ambroiſe Paré, Liv. X. Chapit. 32. pag. 251.

fully change the ſituation of the parts; as Euſtachius has well expreſſed in his anatomical tables, in the thirtieth of which the right arm is ſhown elevated, and the cubitus inflected, the left arm extended with the cubitus turned downward. If now we compare the right and left ſide of this figure, we ſhall ſee a conſiderable difference in the poſture of the parts.

By certain ſigns that the lungs adhere, *&c.*] Tho' the lungs, during life, always remains contiguous to the pleura, as well in expiration as inſpiration, as we are aſſured from phyſiology; yet the lungs are naturally at free liberty in the cavity of the thorax, adhering to the trachea by its air-veſſels, and to the heart by its blood-veſſels, but in no part naturally adhering to the pleura. Now the chief cauſe which prevents theſe parts from growing to each other, ſeems to be a thin dew or moiſture which is continually exhaled every moment of life from ſmall arterial ducts, which open throughout the whole ſurface of the lungs and pleura, and prevent the concretion of one with the other. And this circumſtance we find is beautifully obſerved by Hippocrates, with his uſual brevity or conciſeneſs of expreſſion, when he ſays, [b] *Omne enim non concretum, ſive cute, ſive carne tegitur, cavum eſt, impleturque ſanum quidem ſpiritu, infirmum vero ichore:* "For every part of the body which is not ſo-"lid or grown together, but lined either with ſkin "or fleſh, is hollow in a healthy ſtate, repleniſhed "with vapours, but in a morbid ſtate contains ichor." But when the larger veſſels are ſo diſtended in an inflammation, as to compreſs theſe ſmall exhaling arteries, they will not then be able to diſcharge their thin liquor, but the dry ſurfaces of the inflamed membranes ſpeedily cohere together; whence it is that we ſo often meet with adheſions of the lungs to the pleura after a pleuriſy, peripneumony, empyema, *&c.* If therefore it ſhall appear that the wounded patient has been afflicted with theſe diſorders, we ought then

[b] Hippoc. de arte, cap. 8. Charter. Tom. II. pag. 150.

to

to think of this adhesion: for if the wound entered a part of the thorax where the lungs adhered to the pleura, the instrument in that case might pass a considerable length into the substance of the lungs, without perforating the cavity of the thorax. But this may be known, if the water injected by the mouth of the wound with a syringe, excites a cough, and is discharged through the wind-pipe; for in this case the wound has entered the lungs without penetrating the cavity of the thorax.

These are the signs by which it is usually determined whether the wound has injured the external parts only, or also penetrated into the cavity of the thorax. But it may sometimes happen, that all these signs, though accurately examined, may prove fallacious; especially if the wound was inflicted by a narrow instrument; for then the fat may so close up the wound after the instrument is extracted, that it will neither afford a passage to the air, probe, or injected water, and yet the wounded vessels of the lungs may extravasate their blood into the cavity of the thorax. It will therefore be necessary at the same time, to consider whether the respiration is injured; for if the cavity of the thorax be lessened either by the ingress of air or extravasated blood, the respiration will always become more difficult: and if this symptom appears after a wound inflicted in the thorax, there is some reason to suspect the wound both to be dangerous, and to have perforated the cavity of the thorax, even though no other symptoms are seen. The utmost caution is here necessary, lest the surgeon or physician should gain discredit, by supposing a dangerous or even fatal wound in this part, to be of little or no moment.

SECT. CCXCVIII.

IF the wound (297) deſcends obliquely above or within the ribs, even then matter is frequently depoſited in the cavity of the thorax by an eroſion of the pleura; and this more eſpecially, if the egreſs of the matter by the external wound is any how impeded; and thus an empyema is formed, from whence ariſe many bad conſequences.

Though it appears evidently that the wound does not penetrate into the cavity of the thorax, yet the worſt ſymptoms may follow thence. For if the wound deſcends deeply among the muſcles, and its orifice lies higher, the extravaſated humours will be therein collected, ſtagnate and corrupt ſo as to form various ſinuſes, and after eroding the pleura, it may at length paſs into the cavity of the thorax: the matter having once found a vent into the thorax from the ſinuous ulcer, will be daily augmenting ſo as to form an empyema; and the lungs thus ſoaking in corrupt matter, which becomes daily more acrimonious, will be themſelves conſumed; ſo that after the greateſt calamities death itſelf will follow. The maladies we now ſpeak of are always the worſt, when a ſinuous ulcer of this kind runs behind the ribs; for then there is no opportunity either to compreſs the parts, or dilate the wound to promote the diſcharge of matter. And if the boney or cartilaginous ſubſtance of the ribs and ſternum are affected, many other bad conſequences may again follow from thence, ſo as to render the cure extremely difficult; as will be more apparent, when we come to treat of diſeaſes in the bones. In confirmation of this, we have a remarkable inſtance given us by Galen [a]. A lad received a blow upon his ſternum in

[a] De Anatom. adminſtr. Lib VII. cap. 13. Chart. Tom. IV. p. 161.

the

the field of exercise; it was first neglected, and afterwards badly healed: but four months afterwards matter appeared in the part which received the blow; the physician incised the part, and soon enough brought it to cicatrise, as he thought. But a new inflammation appearing afterwards, the part was again incised; nor could the wound be now brought to cicatrisation. Galen and several other physicians being called after this, found the os sternum carious, and though all of them were unwilling to undertake the cure, Galen extirpated the foul part of the sternum; and found the subjacent pericardium in part putrefied, so that he could see the heart naked; and yet the lad was cured in no long space of time. This seems to be the case also which Galen mentions in the beginning of his first book, concerning the sentences or opinions of Hippocrates and Plato, (the four first chapters of which book treat on the trunk only) where he says, he saw the heart as plainly in a lad, as when it is designedly exposed by the dissection of animals; and adds, that this lad was afterwards cured [b]. But above all, these bad consequences are most to be feared, when the external discharge of the matter is impeded, either by the disposition of the wound or a perverse treatment.

SECT. CCXCIX.

THerefore emplaisters, compresses, and tents ought not to be used in these wounds; but on the contrary, they should be treated with soft deterging balsams, with pledgits of soft lint, and a slack bandage, assisted by a convenient posture of the body.

[b] Galen. de Hippoc. & Platon. placit. Lib. I. cap. 5. Charter. Tom. V. pag. 78.

Since

Since therefore so many and so great injuries may arise from wounds in the thorax, by the retention of humours extravasated into the cavity of the wound, where they frequently make new passages through the cellular membrane, it is therefore evident that a free discharge ought to be procured for the matter with the utmost industry. But it is a common practice with surgeons in most wounds, and especially in those of the thorax, to introduce tents for preventing the upper orifice of the wound from healing before its bottom, and to make way for the discharge of foreign bodies contained in its cavity, and also to facilitate the application of medicines down to the fundus of the wound. But the very skilful surgeon Belloste (to whom we owe the happy contrivance of perforating bones with small foramina to regenerate their periosteum, as we observed in § 252, 262.) was bold enough to oppose the torrent of this practice, and has with solid arguments demonstrated the pernicious effects of tents in wounds, and especially in those of the thorax [a]: and he has likewise shown by many good instances, that practice confirms what reason had thus dictated. For tents, formed of scraped lint contorted, or other of the like substances, being inserted into the mouth of the wound, swell by absorbing the extravasated humours, insomuch that they will thus soon thrust themselves out of the wound, if they are not restrained by a plaister or bandage: but if they are confined from being thus discharged, they swell and dilate the orifice of the wound by a slow laceration of its fibres and vessels, not without extreme pain and irritation to the parts; and while they stop the orifice of the wound, they hinder the discharge of matter or other humours extravasated, which will be therefore forced to make themselves new passages, and may by that means convert the wound into a sinuous ulcer of a bad condition; or else after eroding the pleura, they may enter the cavity of the thorax,

[a] Belloste Chirurgien d'Hôpital, pag. 1——43.

and

and produce incurable miſchief. Add to this, that the capacity of the thorax is continually changing every moment of life, and the ribs with their connexed muſcles are perpetually in motion even in the moſt gentle reſpiration; whence ſuch a wound would never be at reſt, but continually rubbing againſt the ſides of theſe tents; from whence follow pain, inflammation, and at length a calloſity in the lips of the wound, which muſt be afterwards removed before the wound can be healed. From all which it is ſufficiently evident, that no good can be expected from the uſe of tents in wounds of the thorax. And though they may be in ſome meaſure ſerviceable in dilating the mouth of a wound too much contracted, yet that may be better and more eaſily performed by the knife, as we ſaid in § 238: or if a tent is required to be uſed for this purpoſe, the application of it for a day or two may be ſufficient, ſince this does not require the uſe of tents during the whole time of the cure. Even a tent of ſponge rightly prepared, (as we directed under the afore cited aphoriſms) being introduced into the orifice of the wound, will make a conſiderable dilatation of it even in a few hours. For the ſame reaſon it is alſo evident, why the uſe of tenacious emplaiſters is here pernicious: namely, becauſe they impede the free diſcharge of humours from the wounds. The beſt dreſſings therefore for wounds of the thorax are flat pledgits of lint, ſpread with ſome vulnerary balſam or ſoft digeſtives, according to particular circumſtances: over theſe to apply a plaiſter not too tenacious, but perforated with ſeveral ſmall holes, retaining them with a convenient bandage, when neceſſary; being yet cautious not to compreſs the mouth of the wound by the compreſſes or bandage, ſo as to hinder the diſcharge of the extravaſated humours.

Hippocrates obſerves, [b] *Quicumque thoracem vulnerati externa parte vulneris ſanati ſunt, interna non, periclitantur, ne ſuppurati fiant. Quibus autem debilis*

[b] In Coacis Prænot. N°. 430.

intus

intus facta fuerit cicatrix, facile disrumpitur: "That "whoever, having a wound in the thorax, has the "external part of the wound healed before the inter- "nal, he is in danger of a suppuration or abcess inter- "nally. And in those who have a weak cicatrix "formed inwardly, it may be easily broke open." Hence it is evident, that the greatest caution ought to be used to procure a consolidation of the internal parts of the wound, before the external orifice is closed. This may perhaps seem to be an argument in favour of the use of tents, for preventing a concretion of the external lips in wounds; but if it is considered that the tent occludes the mouth of the wound in such a manner, that the matter cannot be discharged, it will rather appear to hinder the consolidation internally; since the matter confined in the wound will prevent the contact of the parts necessary to their union, and being accumulated, will form new passages betwixt the muscles, and by that means increase the wound internally. But that it is contrary to the opinion of Hippocrates to stop up the mouth of such a wound with tents, may appear from another remarkable passage in the same author, which may serve to explain the passage last cited from his *Prænotiones Coacæ*. For he says, (using the same word ἔμπυοι, as in the last passage, and which is frequently used for an empyema, or collection of matter in the cavity of the thorax: *Quicumque à vulneribus purulenti fiunt sive hasta, vel pugione, vel jaculo intus vulnerati sunt, quamdiu quidem ulcus foras respirationem habeat per antiquum vulnus, & hac frigidum in se attrahat, calidum vero à se emittat, tum pus facile, tum sane si quid aliud expurgatur. Et si quidem interna et externa pars simul sanescant, omnino sanus evadit. Sin vero externa quidem pars sanescat, interna vero non, purulentus* (ἔμπυος) *fit. At vero si simul tum interna tum externa pars sanata sint, cicatrix autem intus debilis aspera et livida existat, quan-*

[c] Hippocrat. de morbis, Lib. I. cap. ix. Charter. Tom. VII. pag. 542.

deque

doque refricatur ulcus, et ab hoc purulentus evadit: "That whoever, being wounded internally, either by "a dart, ſpear, or dagger, has a congeſtion of mat- "ter from the wounds, that matter, and indeed any "other foreign ſubſtance, will be eaſily diſcharged, "ſo long as the ulcer has a communication externally "by the old wound, which matter is drawn in by "cold, and diſcharged by heat. If now the internal "and external parts conſolidate at the ſame time, "the wound will be perfectly healed; but if the "external parts unite without the internal, a con- "geſtion of matter will be formed. But even when "the internal and external parts unite at the ſame "time, if the cicatrix is internally weak, rough and "livid, the ulcer will ſometimes return, and a con- "geſtion of matter be thence formed again."

From which paſſage it is ſufficiently evident, that the cure ought not to be attempted by the uſe of tents, to procure an equal conſolidation of the parts both internally and externally; but the poſture of the body ought to be ſuch, that the contained humours in the cavity of the wound may by their own weight ſubſide to the external opening; and when the bottom of the wound is lower than its orifice, and this cannot be remedied by a convenient poſture in the patient, compreſſes ought to be applied to the bottom of the wound, and a proper bandage uſed to force the contained humours to the opening of the wound; and thus the parts will readily unite internally at the bottom of the wound, when they are brought into contact by diſcharging the confined humours. In the mean time, the matter diſcharged by the external orifice, will eaſily prevent that from uniting before the internal parts are healed. But if the internal ſurface of the wound, being foul, requires to be cleanſed before it can be expected to heal; then thoſe remedies may be applied which we enumerated in § 207, and of which we ſhall alſo ſpeak hereafter in the cure of fiſtulæ. The uſe of theſe remedies ought to be continued

tinued till the wound affords a white, ſmooth, viſcid, uniform, inodorous and taſteleſs matter; and then a conſolidation of the wound, now cleanſed, may be attempted by an approximation of the ſides by a gentle compreſſure, carried gradually from the bottom of the wound towards its orifice.

SECT. CCC.

WE know that the wound penetrates into the cavity of the thorax, 1. by conſidering the cauſe and magnitude of the wound; 2. by ſearching with a probe, when the body is placed in the poſture in which it received the wound; 3. by the patient's drawing the air forcibly into his lungs while the wound is cloſed, and then ſhutting his mouth and noſe, to make the ſame effort as in expiration, when the air will ſuddenly ruſh through the mouth of the wound, and often form a ſound or noiſe by its agitation in the cavity of the thorax; 4. by inſpection; 5. by an emphyſema; when the air contained in the cavity of the thorax being continually augmented by the action of the wounded lungs, rarified, compreſſed by inſpiration, and its free eſcape through the wound prevented, by inſinuating betwixt the lips of the wound, forces its way into the cellular membrane, where increaſing, it often cauſes a ſoft pellucid tumour throughout the whole body, (excepting the ſoles of the feet, and palms of the hands) in ſome places to the thickneſs of eleven inches. See the hiſtory of the royal academy of Sciences for the year 1713. pag. 15, 18. alſo 4, 14. and 119, 120. where an

an account is given of a fatal emphyſema from a fracture of the ribs without a wound of the ſkin; 6. from the diſcharge of frothy blood.

Great caution is neceſſary in determining whether or no the wound penetrates into the cavity of the thorax; for this cavity aſcends much higher before than behind, where it deſcends lower: from whence groſs errors have been ſometimes committed, in thinking a wound penetrated the thorax, when it in reality entered the cavity of the abdomen. Thus we read in Ruyſch [a], of an ignorant ſurgeon dwelling in ſome part without the city, who being deſirous to perform the paracenteſis of the thorax, ſent for him into conſultation; but Ruyſch being indiſpoſed and unable to come, the ſurgeon by himſelf perforated the thorax as he thought; but ſoon after a large number of hydatids forced themſelves out through the wound, and the ſurgeon being affrighted, ſtopped the wound with a tent, and had recourſe to Ruyſch, but to no purpoſe, for the unhappy woman died ſoon after; and upon opening the body, nothing of water appeared in the thorax, but the ignorant ſurgeon in perforating the abdomen inſtead of the thorax had wounded the liver, which in that part adhered to the peritoneum, and ſeemed to have degenerated into hydatids, which burſt forth through the wound. From whence it is evident, how well one ought to be acquainted by anatomy with the true ſituation and connection of the diaphragm, in order to determine any thing with certainty in theſe wounds.

But wounds inflicted in the cavity of the abdomen may paſs into that of the thorax, by perforating the diaphragm: for diſcovering which there are no certain ſigns, and we ſeldom diſcover it but by opening the body after death; and of this we related ſome inſtances in the comment on § 170. numb. 4. But

[a] Obſervat. Anatom. Chirurg. Centur. Obſervat. LXV.

wounds

wounds properly ſaid to perforate the cavity of the thorax, of which we are now treating, are diſcovered by the following ſigns.

1. Since almoſt all inſtruments which wound with a ſharp point are of a conical figure; it is evident, that the width of the wound, compared with the wounding inſtrument, may indicate how far the inſtrument has penetrated: but then this ſign may deceive one, when the wound runs obliquely over the ribs among the muſcles; for in that caſe the wounding inſtrument may enter to a conſiderable length, without penetrating the cavity of the thorax.

2. Of this we treated in § 168. numb. 1. and § 297. where it appeared that by changing the poſture of the body from that in which it received the wound, the paſſage of the probe might be eaſily obſtructed by the intruſion of the fat, and by the different poſition of the muſcles.

3. Of this ſign we treated in § 297. But in performing this, great care is to be taken not to let any air paſs into the cavity of the thorax during the experiment; for by diſtracting the lips of the wound, in dilating the thorax by inſpiration, it may be very poſſible for air to enter its cavity: For in fat people the membrana adipoſa often ſtops up the wound penetrating the thorax, after the inſtrument is extracted, ſo that no admittance is given to the air; and therefore when this experiment is made, the lips of the wound ought to be firſt carefully compreſſed, and then the wounded patient, after having retained the air forcibly inſpired, ſhould next ſhut his noſe and mouth, and ſtrongly endeavour to make the effort of exſpiration. Thus the confined air expanded by heat will very much dilate the lungs, by which means the air lodged betwixt the lungs and pleura will be compreſſed, and likewiſe rarified at the ſame time by the warmth of the parts; the wound being now opened, there will be no danger of the external air entering through it into the cavity of the thorax, becauſe the lungs

lungs greatly expanded will be applied close to the sides of the pleura, if no air is as yet contained in the thorax; but if any air has already entered its cavity, it will overcome the pressure of the atmosphere, by its rarifaction from the warmth, and compressure by the expansion of the lungs, so that it will rush out forcibly through the wound. But if the wound was such or so large as to admit a very free ingress of the air into the cavity of the thorax, and yet not so large as to much exceed the aperture of the glottis, (*vide* § 170. num. 4.) in that case the air will enter into and return out of the cavity of the thorax by the wound with a very manifest noise; and then there is not the least room to doubt of its penetrating.

4. Of this sign we treated in § 297.

5. We took notice of this wonderful symptom before, in § 244, so far as it sometimes attends wounds of the head: but it is much more frequently an attendant on wounds of the thorax penetrating its cavity, in which this surprizing kind of tumour may be spread in a little time throughout the whole body. For the air having entered into the cavity of the thorax through the wound, whose external orifice is at the same time closed by the fat, sticking plaisters, or other dressings; this confined and rarified air often forces itself a way into the cellular membrane, or spreads through the panniculus adiposus. But more especially very large tumors of this kind arise, when the air-vessels of the lungs are injured by the wound, so as to deposite their inspired air into the cavity of the thorax; for in that case the malady increases every moment. Parey gives us a wonderful case, resulting from this cause which we before related from him in the comment on § 249. In this case the wind-pipe appeared to be wounded in the neck, and the air escaping from the wound insinuated into the cellular membrane or panniculus adiposus, and so surprizingly tumified the face, that neither eyes nor nose could be discerned. And when the wounded patient was given

over by others, a ſkilful ſurgeon by making deep ſcarifications into the panniculus adipoſus, diſcharged the included flatus, and in a manner recovered the patient from the jaws of death [b]. A wonderful emphyſema following a wound of the thorax, penetrating the ſubſtance of the lungs, is deſcribed in the memoirs of the royal academy of ſciences at Paris [c]. A man thirty years old, of a ſanguine and fleſhy habit, received a wound penetrating the cavity of his thorax, of which he expired on the fifth day. But before death his whole body was ſurprizingly ſwelled with an emphyſema, excepting the ſoles of his feet, palms of his hands, and the vertex of his head. Upon the thorax this tumour was eleven inches thick; upon the abdomen, nine; in the neck ſix, and in the other parts of the body it was four inches. The eyes in this dead body were in a great meaſure thruſt out of their orbits, from the cellular membrane being diſtended with a great quantity of air. There is ſtill another extraordinary caſe of this kind mentioned in the ſame book [d], of a fatal emphyſema ariſing from a fracture of the ribs, the ſkin remaining entire. A man ſixty years old had the fourth and fifth of his true ribs broke in the middle of the left ſide, by ſome wheels paſſing over his breaſt: ſoon after a conſiderable ſwelling appeared in the affected ſide, from the entrance of the air into the panniculus adipoſus; which tumour increaſed daily, with a difficulty of reſpiration, till on the fourth day after the accident the man expired. In this body an emphyſema appeared all over its ſurface, except the palms of the hands and ſoles of the feet. Upon dividing the ſkin and the reſt of the integuments which covered the broken ribs, a ſmall and ſcarce perceptible aperture was found thro' the intercoſtal muſcles, without any ecchymoſis; and upon opening the thorax, a ſmall laceration was

[b] Les Oeuvres d'Ambroiſe Paré, Liv. X. Chapit. 30. pag. 249.
[c] Acad. des Sciences, l'an. 1713. Mem. p. 5, &c.
[d] Ibid. Mem. pag. 154, &c.

obſerved

obſerved in the external membrane which inveſts the lungs, part of the membrane adhering yet to the lungs, and part to the broken rib; but no extravaſated blood was found in the cavity of the thorax.

From hence it is ſufficiently evident, that emphyſematous ſwellings frequently ariſe from wounds in the thorax; eſpecially when the wound admits air into the cavity of the thorax, while at the ſame time it is by any cauſe prevented from eſcaping again through the orifice of the wound. But theſe obſervations teach us, that the very largeſt of theſe emphyſematous tumours will be produced, if the lungs are alſo injured ſo as to tranſmit their air into the cavity of the thorax; eſpecially when there is no conſiderable hæmorrage at the ſame time: for the blood filling the cavity of the thorax, would prevent ſo large a quantity of air from being accumulated in the cavity, ſufficient to inflate the cellular membrane of the whole body. Hence the reaſon is alſo evident, why one may juſtly conclude the wound has penetrated the cavity of the breaſt, when one of theſe emphyſematous ſwellings appear ſoon after a wound inflicted in the thorax.

6. This ſign certainly denotes the lungs to be injured: for in that caſe the blood, flowing from the wounded blood-veſſels into the air-veſſels of the lungs, by mixing with the air it will become frothy; and therefore frothy blood will be coughed up from the wind-pipe, or elſe the ſame blood will run in a ſtream from the external wound. But the lungs cannot be injured, unleſs the wounding inſtrument ſhall have penetrated into the cavity of the thorax; except the lungs ſhould happen to adhere to the pleura in the part wounded, of which we treated in § 297. [e] Virgil has beautifully expreſſed this circumſtance, where he deſcribes Antiphaten to be wounded by Turnus.

[e] Æneid. Lib. IX. verſ. 700, &c.

Volat Itala cornus
Aera per tenerum, ſtomachoque infixa ſub altum
Pectus abit: reddit ſpecus atri vulneris undam
Spumantem, & fixo ferrum in pulmone tepeſcit.

For the ſame reaſon if frothy blood is ſpit in diſeaſes, it is ſuppoſed to come from the lungs.

SECT. CCCI.

THE effects or conſequences of ſuch a wound are frequently, 1. a preſſure of the air, which has entered the thorax, upon the ſurface of the lungs, by which means they are indiſpoſed both for reſpiration and for circulating the blood; 2. an extravaſation and accumulation of blood within the cavity of the thorax; 3. a putrefaction of the juices which are extravaſated, heated, agitated, and confined on all ſides; 4. Hence a maceration, eroſion, corruption, and fætor of the pleura, lungs, mediaſtinum, diaphragm, and pericardium; 5. an infinite number of diſorders ariſing from theſe laſt; 6. ſpitting of blood.

We have here enumerated the diſorders or accidents which have been ſometimes obſerved to follow wounds penetrating into the cavity of the thorax; all which reſult either from the admiſſion of the air, or the extravaſation of the juices.

1. It was before demonſtrated in the comment on § 170. numb. 4. that naturally there is never any air, in a healthy perſon, betwixt the lungs and the pleura; and that this was neceſſarily required, in order that the lungs might be diſtended with air ruſhing through the glottis, by the dilatation of the thorax. Whence it follows, that ſo ſoon as the air is admitted by a wound, into the cavity of the thorax, it will evi-

evidently impede the free expanſion of the lungs, or even totally prevent their expanſion, if the wound is large. In the place here cited, we made it evident from various experiments, how far, and under what reſtrictions, this aſſertion is true. For if the air has a very free paſſage through the wound, the lungs cannot be dilated; but if a ſmaller quantity of air enters through a narrow wound than can enter through the open rimma of the glottis, the lungs will then be in ſome meaſure expanded, though not to ſuch a degree as they ought in a ſtate of health. This is a thing very well expreſſed by Galen [a], when he ſays, *Notum vero eſt, inſpiratione per animantis os facta, tantum neceſſario perire ob vulnus, quantum ejus loco extrinſecus influit circumflui aeris in thoracem. Quanto autem minus inſpiraverit per os ad neceſſitatem, tanto etiam minus efflari; quanto autem efflatio decreverit, tanto vocem ſequi breviorem neceſſe eſt:* "It is a thing well known, "that the inſpiration made by the mouth of an ani- "mal muſt neceſſarily be diminiſhed by a wound, in "proportion to the quantity of ambient air that "flows into the cavity of the thorax. But of neceſ- "ſity leſs air muſt be expired, in proportion as leſs "was inſpired by the mouth; but as much as the ex- "piration is leſſened, ſo much muſt the voice become "ſhorter from thence of neceſſity." If now the air which has entered the cavity of the thorax is from any cauſe confined, or prevented from eſcaping again through the orifice of the wound, it will be rarified or expanded by the heat, and by ſtrongly compreſſing the lungs, obſtruct the inſpiration and the dilatation of the lungs thence following: and which is required in the animal after birth, that the blood expelled by the right ventricle may paſs freely through the narrow extremities of the pulmonary artery. But the rational of all theſe may eaſily be deduced from the known properties of the air, and from thoſe requiſites which

[a] De Anatom. adminiſtrat. Lib. VIII. cap. 3. Charter. Tom. IV. pag. 172.

demonſtrated from phyſiology to be neceſſary for the performance of reſpiration, and for the free circulation of the blood through the veſſels of the lungs.

2. If for example the intercoſtal arteries were wounded, the extravaſated blood may be collected to a conſiderable quantity within the cavity of the thorax; for the adjacent heart drives the blood with a great force into theſe arteries; and the motion of the thorax in reſpiration prevents the injured arteries from reſting and cloſing ſo ſoon as they otherwiſe might. If at the ſame time the blood veſſels of the lungs are alſo wounded, it is very evident that a large quantity of blood muſt be ſuddenly accumulated; but if the largeſt blood veſſels paſſing out from the heart are injured, death ſoon follows. But if the blood thus extravaſated is not diſcharged by the external aperture of the wound, it will be collected in the cavity of the thorax, and hinder the free dilatation of the lungs, whence extreme anguiſh and difficulty of reſpiration.

3. The blood thus extravaſated and confined in a warm and moiſt place, and continually agitated in reſpiration, will therefore very eaſily degenerate and acquire a corrupt or putrid ſtate, eſpecially when the air has almoſt continually acceſs through the wound, penetrating into the cavity of the thorax; as alſo when the air is admitted into the cavity of the thorax in inſpiration, by a wound in the air veſſels of the lungs. The obſervations which have been made in ſurgery teach us, that this extravaſated blood will putrefy in a very ſhort ſpace of time. In our commentaries on § 172. numb. 3. where we treated of theſe diſorders, we related the caſe of a ſoldier who was wounded in the thorax in ſuch a manner, that he diſcharged blood by coughing from the mouth, and the ignorant ſurgeon ſo united the lips of the wound by future, that nothing could diſcharge itſelf. Parey being called in on the next day, immediately cut open the future, and with his finger removed the thrombus of congealed blood, which obſtructed the orifice

of

of the wound, and extracted eight ounces of blood from the cavity of the thorax, already fetid and corrupted. In a nobleman, who had received a wound from the thruſt of a ſword penetrating the cavity of the thorax, after the loſs of ſeven or eight pounds of blood, Belloſte [b] extracted ſix or ſeven ounces of blood already half corrupted, upon removing the dreſſings, towards the end of the day in which the wound was received. And Hippocrates tells us [c]; *Quodſi ſanguis ex vulnere aut vena fluxerit in ſuperiorem ventrem, neceſſe eſt illud pus fieri*; "That if blood runs from a wound or blood "veſſel into the thorax, it will of neceſſity turn into "matter." But it was demonſtrated before in the commentaries on § 172. numb. 1. where we cited a like paſſage from his aphoriſms, that by this term of ſuppuration he underſtands any kind of corruption of the blood whatever; as Galen has obſerved in his explanation of that aphoriſm.

4. The putrefaction ſo ſoon formed in the extravaſated blood, will be every moment increaſing; for there is here a very conſiderable heat from the vital viſcera adjacent; from whence the blood will be converted into a putrid maſs. The lungs lodging in this corroding and putrid liquor will themſelves be macerated and putrefied; and the like will alſo happen to the pericardium, pleura, *&c.* It appeared in the preceding paragraph, that the blood extravaſated into the cavity of the thorax may very ſpeedily corrupt; and that it may there acquire the higheſt degree of putrefaction we are taught by obſervations. In a man who was wounded in the back, ſo that the ſword entered the cavity of the thorax and penetrated the left breaſt, after the moſt malignant and preſſing ſymptoms, the paracenteſis of the thorax was performed; and on the ſixth day after the infliction of the wound a very conſiderable quantity of matter was diſcharged, but ſo fetid that no one dared to ſtay in the chamber

[b] Le Chirurgien d'Hôpital, pag. 93. [c] De morbis, cap. 2. circa finem. Charter. Tom. VII. pag. 533.

where the patient lay [d]. In another patient, after the third day from the reception of the wound, which Sculetus dilated, near a pound of blood discharged itself from the cavity of the thorax, but of so hot a nature, that it seemed to burn the patient as it ran out more than a flaming candle [e]. It is therefore no wonder that the substance of the viscera may be consumed and eroded by macerating in such a putrefied mass of humours, and which as we read in Hildanus [f] has produced the same effect on the compact substance even of the heart itself. A countryman employed in carrying of damp hay, received from thence an injury to his destruction; he felt a sense of pain with a kind of oppression at his heart, and complained of a difficulty in breathing; but four days afterwards he returned to his labour. But some days more being elapsed, he was taken with a burning fever, asthma, delirium, watchings, faintings, &c. and expired on the eleventh day of the disease. In opening the body the pericardium was found replete with a foul matter, in which the heart, appearing to be in a manner surrounded, was found eroded or dissolved for a considerable space, towards the each auricle chiefly; and the lungs appeared to partake of the same disorder.

5. The extravasated humours may by their compressure or putrid and eroding acrimony disturb or abolish all the functions of those viscera which are placed in the thorax. Hence a dyspnœa of the worst kind, violent palpitations of the heart, intolerable anxieties, inflammations, ulcerations, gangrene, &c. may follow in these parts. But the extravasated blood putrefying and becoming attenuated by the heat of the parts, and by stagnation, may be absorded by the bibulous veins seated in the surface of these parts, and mixing with the blood may produce a putrid ca-

[d] Scultet. Armament. Chirurg. Observ. 43. pag. 255.
[e] Ibid. Observ. 50. pag. 262.
[f] Observat. Chirurg. Centur. 2. Observat. 27. pag. 106.

chochymy

cochymy of the worſt kind: from hence follow putrid and acute fevers, tranſlations of the abſorded putrid matter to other parts of the body, a phthiſis, atrophe, and death. From all which it is juſtly concluded, that an infinite number of the very worſt diſeaſes may ariſe from humours extravaſated within the cavity of the thorax.

6. If blood be ſpit up immediately after the infliction of the wound, it is a ſign that the lungs are injured, eſpecially if it appears frothy: and therefore in that caſe blood may eſcape into the cavity of the thorax from the wounded veſſels of the lungs, unleſs perhaps the lungs ſhould adhere to the pleura in that part where the wound was received. If blood is ſpit up ſome days after the wound was received, that may proceed from the extravaſated blood being attenuated by heat and reſt, and re-abſorbed by the veſſels of the lungs. In what manner this is done I ſhall not diſpute; but certain it is, that even an empyema has been cured by a purulent ſpitting. In a true pleuriſy, the ſpitting of a yellow matter mixed with ſtreaks of blood often terminates the diſeaſe, as we are aſſured from innumerable practical obſervations. All this proves the poſſibility there is for the extravaſated blood within the cavity of the thorax to cauſe a bloody ſpitting.

SECT. CCCII.

THE ſigns of blood extravaſated within the cavity of the thorax are, 1. an orthopnœa, or ſuch a difficulty in reſpiration, that the patient is obliged to breathe erect. 2. The patient's lying eaſieſt on his back, it being very uneaſy for him to lie on the wounded ſide, and impoſſible for him to lie on the ſound ſide. 3. The conſequences deſcribed before in (301). 4. A weight or heavineſs on the diaphragm. 5. A fluctuation

of the matter. 6. The nature and ſituation of the inflicted wound. 7. Great weakneſs, with paleneſs and cold ſweats. 8. A conſtant increaſe of almoſt all the ſymptoms.

After it has appeared evidently, that the wound has penetrated the cavity of the thorax, another queſtion of great importance muſt then be aſked; namely, whether the divided veſſels have extravaſated any conſiderable quantity of blood within the cavity of the thorax? And this cannot always be eaſily determined, ſince many of the ſigns which we ſhall hereafter enumerate may prove fallacious; and therefore the concurrence of ſeveral of theſe ſigns is required in order to determine any thing with certainty in this matter. But it may be evidently of the worſt conſequence for a phyſician or ſurgeon to be miſtaken in his diagnoſis here, ſince the extravaſated blood ought to be diſcharged either by the wound or by making a new apertion: but if the thorax be thus perforated, while no blood is confined in its cavity, it will admit the air, which is always pernicious here, and the wound will be therefore irritated, *&c.* whence it follows, that one ought to attend to every circumſtance with the greateſt caution, leſt the patient ſhould ſuffer by an operation without neceſſity, or the ſurgeon be injured in his reputation.

1. An orthopnœa is ſaid to be a ſhort, difficult, and noiſy reſpiration, which the patient can perform only with his neck and breaſt erect; and which always denotes, that the free expanſion of the lungs by the inſpired air is impeded from ſome cauſe. But ſince the blood extravaſated within the cavity of the thorax occupies the ſpace that the dilated lungs ought to fill, it is therefore very evident, that this may cauſe a difficult reſpiration. But while the patient holds his body in an erect poſture, the extravaſated blood preſſing by its weight on the diaphragm will augment the

the cavity of the thorax, by which means the lungs may then receive a ſomewhat farther expanſion; or at leaſt they may be dilated more in that poſture of the body than in any other. Yet if this ſign be attended to alone, it may deceive one: for the air, which entered the cavity of the thorax by the wound, may impede the free expanſion of the lungs and cauſe an orthopnœa. A ſpaſmodic conſtriction of the lungs in aſthmatic people produces the like diſorder; ſo that if the patient wounded ſhould have been ſubject to an aſthma, this will be no very certain ſign.

2. This is a ſign of very great moment. For the diaphragm deſcending or being continued lower on the back part of the body, much increaſes the capacity of the thorax; ſo that the blood extravaſated within the capacity of the thorax will naturally ſubſide to the lower and back part of the thorax, when the patient lies down; and the back part of the diaphragm will deſcend more eaſily, for the middle of it is tendinous, to which the broad baſis of the pericardium is attached, and therefore cannot eaſily be depreſſed, as we ſaid before in the commentary on § 170. numb. 4. from whence it is evident, that the extravaſated blood will be lodged eaſier in this poſture than in any other. But when the patient lies on the injured ſide, the poſture of the body will be more painful, though tolerable; but if the patient lies on the ſound ſide, the weight of the extravaſated blood will preſs the mediaſtinum and pericardium towards the other ſide of the thorax, whence its capacity will be diminiſhed, and the difficulty in reſpiration increaſed; which the patient in this poſture no ſooner perceives, but he immediately changes it or turns himſelf, even againſt his inclination, to avoid ſuffocation.

3. Theſe conſequences reſult chiefly from the putrefaction of the extravaſated blood, and the morbid impreſſion on the viſcera, which is made by ſuch a putrid maſs: ſo that from theſe we may indeed diſcover

ver the exiſtence of extravaſated juices, but this frequently too late.

4. While the patient is fixed in an erect poſture, the whole weight of the extravaſated blood preſſes the diaphragm downwards: therefore at that time the patient perceives the ſenſe of an incumbent weight, with a pain about thoſe parts to which the diaphragm is connected. Frequently alſo a tumour appears in that ſide of the abdomen where the diaphragm is depreſſed; inſomuch that ſometimes, in an empyema, the diaphragm is ſo much depreſſed, and gradually extended by the quantity of the confined matter, that it cauſes the abdomen to protuberate in the manner of an aſcites.

5. Where there is any ſuſpicion of confined matter within the cavity of the thorax. Hippocrates [a] orders the patient to be ſeated in a fixed chair after the plentiful uſe of warm bathing; and while ſomebody holds his hands, the phyſician muſt endeavour to diſcern on which ſide the noiſe or fluctuation is made while the ſhoulder is ſhook. And the ſame method he takes to diſcover a latent dropſy in the cavity of the thorax [b], and to determine the place, by opening which the ſerum collected in the thorax may be diſcharged. But it is eaſily apparent, that this ſign may ſometimes deceive one, for while the extravaſated blood is collecting in the cavity of the thorax, it congeals by ſtagnating, and therefore renders its fluctuation very difficult to be perceived; alſo if the thorax is filled with a large quantity of blood, no ſound or noiſe will be heard upon ſhaking the body, by reaſon of the fulneſs; and therefore it is a prudent admonition of Hippocrates [c], when he ſays, *Quibus ſuppuratis, dum concutiuntur humeri, multus ſtrepitus fit, minus puris habent, quam quibus, difficilius ſpirantibus*

[a] De morbis, Lib. II. cap. 16. Charter. Tom. VII. pag. 568.
[b] Ibid. cap. 24. pag. 576. & De internis affectionibus, cap. 24. Ibid. pag. 656. [c] In Coacis Prænot. nº. 432. Charter. Tom. VIII. pag. 877.

&

& melius coloratis, exiguus. Quibus autem ſtrepitus nullus ſit, valida tamen ſpirandi difficultas adeſt, & ungues lividi, pleni ſunt pure, & pernicioſe habent; " In " thoſe empyemas, where a great fluctuation is heard " upon ſhaking the patient's ſhoulders, there is leſs " matter, than where the ſound is weak in thoſe " who breathe more difficultly, and are better coloured. " But in thoſe who have no fluctuation, and are yet " attended with a very difficult reſpiration and livid " nails, theſe are full of matter and in a deplorable " ſtate."

6. For when we know the ſeat of the wound and the courſe of the wounding inſtrument through the parts, we can then tell from anatomy whether or no any large artery or vein is injured. Thus the larger trunks of the intercoſtal arteries run near the lower margin of the ribs; thoſe of the internal mamillary are placed near each ſide of the ſternum, at about the diſtance of a finger's breadth from that bone, behind the cartilages of the ribs. The large vena azygos is ſeated on the right ſide of the vertebræ of the back, *&c.* from a thorough knowledge of all which the wound is concluded to be more or leſs dangerous.

7. There are ſome men ſo puſillanimous, that they will fall down into a deliquium at the ſight of the wounds of others; and in ſuch, all theſe ſymptoms may happen, though they are but ſlightly wounded. But in ſuch a caſe they eaſily recover themſelves by the aſperſion of cold water, or the exhibition of a ſtimulating cardiac; nor does the weakneſs continue long which thence ariſes. But when, after the infliction of a wound penetrating the cavity of the thorax, there directly follows great weakneſs, a contraction and paleneſs of the face, a languid pale look of the eyes, a cold ſweat gathering in drops upon the ſkin, eſpecially upon the face and breaſt, and the pulſe is found ſcarce diſcernible; we then know, that by the wound of the veſſels ſo large a quantity of blood is extravaſated, that ſcarce any returns to the heart, but

that

that the whole mass is either discharged from the wound externally, or else collected within the cavity of the thorax. In such a case therefore the most imminent danger ought to be declared to be at hand; for they suddenly expire. This has been well observed by Hippocrates [d], where he says, *Sanguinem profundentia cum sudatiunculis vulnera maligna. Tales enim loquentes occulte pereunt:* "That wounds which have an "hæmorrhage attended with sweats are malignant: "for such patients expire secretly while they are "speaking." In his [e] *Prænotiones Coacæ* there is also the same sentence; only we there read, ἐφιδρῶσα for ἐπιῤῥιγῶσα, rigors instead of sweats; but he elsewhere observes [f], that rigors follow large hæmorrhages, and says, that the rigor stops the flux of the blood: but then it is evident from what went before, that in this place he speaks of a bleeding at the nose. But when large vessels near the heart have been injured by a wound penetrating the thorax, it is very evident that a rigor may here follow a large hæmorrhage, without producing any stoppage of the flux of blood.

8. The blood-vessels here are very large, and very near the heart: and therefore the blood continues to flow from them into the cavity of the thorax, whence a pressure upon the lungs, anxieties, difficulty of breathing, &c. which increase every moment till the hæmorrhage ceases, either from a contraction of the divided vessels, or from a weakning of the patient's vital forces. Many symptoms may also follow in the patient thus wounded, from the fear, anger, or the like, which accompanies, and which gradually vanish; but those symptoms which result from the hæmorrhage continue as that continues; and therefore a continual increase of the symptoms is always justly reckoned among the signs, by which we know that blood is extravasated within the cavity of the thorax.

[d] Prorrhet. Lib. I num. 130. Charter. Tom. VIII. pag. 791.
[e] N° 328. Charter. ibid. pag. 870.
[f] Prorrhet. Lib. I. num. 152. Charter. ibid. pag. 799.

But when a wound penetrates any of the larger cavities of the body, and the ſigns denote that there is room to fear that the divided veſſels extravaſated their blood in full ſtream inwardly, though no hæmorrhage appears externally; in ſuch a caſe the prognoſis ought to be made with caution, leſt the reputation of the phyſician or ſurgeon ſhould be riſked, if they pronounced no danger: for frequently the patient thus wounded expires unexpectedly, and the death of the wounded patient is imputed to their ignorance, by thoſe who plead the cauſe of the wounder. But how carefully one ought to attend to all the appearances, in order to determine rightly whether or no any extravaſated blood is lodged in the thorax, is evident, inaſmuch as the moſt ſkilful are ſometimes deceived herein. The celebrated M. Mery [g] ingenuouſly confeſſes, that in a young man who was wounded with a ſword in the anterior and upper part of his right arm, within three hours after the wound was inflicted, he obſerved ſo many and ſo great ſymptoms, that he made no doubt but that the cavity of the thorax was full of extravaſated blood, and therefore began ſeriouſly to think of making the paracenteſis of the thorax. But the event afterwards taught that the caſe was otherwiſe, the patient being perfectly cured of his wound within the ſpace of eight days. But it ſeemed highly probable, that the tendon of the pectoral muſcle being injured, occaſioned the ſevere pain of the breaſt, great difficulty of reſpiration, &c.

nerve
Dr Hunter & Baron Haller have ſince proved that the Tendons are insensible
J. J.

SECT. CCCIII.

THE extravaſated blood ought to be immediately extracted, 1. by a convenient poſture, motion and ſtraining of the body; 2. by ſucking through a flexible tube, having holes in its ſides, and obtuſe at the end; 3. by injecting

[g] Academ. des Sciences l'an. 1713. Memoires, pag. 159.

ſome

ſome diluent, attenuating and deterging liquor: 4. by dilating the wound; or 5. by making another opening betwixt the ſecond and third of the lower true ribs, at the diſtance of four fingers breadth from the vertebræ, and as much from the lower angle of the ſcapula, making your inciſion with a knife, parallel to the ribs, betwixt the middle of them, and directing the edge downwards.

After it has appeared from the ſigns enumerated in the preceding paragraph, that extravaſated blood is lodged in the thorax, the curative indication then directs to immediately remove or extract it, leſt it prove injurious by its preſſure or putrefaction; and yet at the ſame time it ought to be particularly remarked, that this extravaſated blood ſhould not be diſcharged before it appears that the injured veſſels have done bleeding. For of what ſervice can it be to diſcharge the blood, if by the motion of the body, ſucking, injections, or the like, the wounded veſſels yet open are ſo irritated, as to continue bleeding. When the pulſe appears ſufficiently ſtrong and equal, the extreme parts of the body feel warm, no hiccup or convulſion appears, and the patient's ſtrength, continues, we then know that the internal hæmorrhage has ceaſed, and that the artifices required for diſcharging the blood from the cavity of the thorax, may be then ſafely uſed.

But it may be doubted whether the extravaſated blood ought always to be diſcharged by art, ſince it is apparent from the moſt faithful obſervations, that blood, matter, water, *&c.* has gradually vaniſhed from the cavity of the thorax, and being abſorded by the veins, has been afterwards diſcharged by ſweat, urine, *&c.* Such a caſe is related by *Fabricius ab Aquapendente* [a]. A friend of his received a wound in

[a] Opera Chirurg. part. 1. Lib. II. cap. 22. pag. 214.

the

the thorax penetrating into its cavity, but so small, that it could not be discovered to penetrate even by the probe; which yet appeared from the spitting of blood, the sense of a weight pressing on the diaphragm, a cough, fever, obstructed respiration, &c. But since nothing could be extracted by the wound, the physicians concluded to make the paracentesis of the thorax on the day following. In the mean time it happened, that the patient discharged a pot full of blood by urine, which relieved him from the pain, fever, and all the other symptoms. Another case of the same nature is to be found in Belloste [b]. A captain received a wound penetrating the cavity of the thorax, and entering the lungs, and all the symptoms appeared which usually attend such wounds. When a vein was opened, instead of blood real matter was discharged to the relief of all the bad symptoms. Our author testifies, that this case was told him by a very expert surgeon, and confirmed to him by several eye-witnesses of inconteſtible credit. A copious discharge by urine, or a plentiful sweat, has been often observed of services in the like cases, by the same author [c]: And there are many more of the like observations to be met with; but these are sufficient to prove, that nature, who so frequently assists herself, often cures such wounds by extraordinary ways. But this does but rarely happen; and it is the part of a prudent physician to attend diligently whether the signs denote that nature is about to make such an attempt: but in the mean time, if we were to trust to nature only in these cases, it is certain that many would perish, from a destruction of the vital viscera by the extravasated and putrid blood, who by an artificial extraction of the same blood, might have been saved. This extraction therefore is to be attempted by the following means:

[b] Chirurgien d'Hôpital, pag. 265.
[c] Ibid. pag. 94, 95.

1. If the blood lodged in the cavity of the thorax is as yet fluid, and the wound being ſufficiently large does not run obliquely thro' the integuments, but directly penetrates into the cavity; in this caſe, if the patient be placed in a convenient poſture, the blood may deſcend by its own weight to the mouth of the wound, and diſcharge itſelf without other aſſiſtance. Therefore in ſuch a caſe the moſt ſkilful ſurgeons apply nothing to the orifice of the wound for ſome hours, that the blood may have a free exit. Thus Dionis [d] treated a man wounded into the thorax under the right breaſt. For when he found the cavity of the thorax full of blood, he firſt dilated the orifice of the wound, and then ordered the patient to lie all night on the wound, ſo that on the next morning he found the cavity of the thorax quite void of any blood, and the wounded patient was happily cured. Parey [e] ordered a man, who was wounded in the ſame manner, to be placed with his feet upwards, and his head downwards, and then introducing his fingers into the orifice of the wound, he removed the thrombus of congealed blood, extracted that which was extravaſated, and delivered the patient from imminent danger of ſuffocation.

This method of diſcharging the extravaſated blood from the mouth of the wound, is by a compreſſure of the abdomen either by the hands or by a broad roller, the patient at the ſame time retaining the inſpired air as long as poſſible, and then making the effort of expiration, while the glottis is cloſed; for thus the lungs being extremely dilated, and the diaphragm preſſed upwards, the blood extravaſated into the cavity of the thorax, will be preſſed out through the mouth of the wound.

2. Since it is often very inconvenient in many wounds of the thorax to keep the patient in ſuch a

[d] Operations de Chirurg. pag. 295, 296.
[e] Liv. X. Chap. 32. pag. 251.

poſture,

poſture, as that the extravaſated blood may diſcharge itſelf by its own weight through the opening of the wound: therefore another method has been contrived; namely, the introduction of a [f] flexible pipe, of gold, perforated in the ſides with many apertures, and furniſhed with a golden probe filling its cavity (which is to fit it for bending without diminiſhing or ſpoiling its cavity) which is to be carefully paſſed tho' the mouth of the wound, as low as poſſible into the cavity of the thorax; and then by ſucking, or by the application of a ſyringe, they evacuate the extravaſated blood. The apex or end of this tube is required to be obtuſe, to prevent it from injuring the lungs. A tube of the ſame form, and for the ſame uſe, may be made of lead; as alſo of flexible leather and whale-bone. With ſuch an inſtrument inflected like a ſiphon or crain, being introduced, and then drawing out the probe, [g] Scultetus extracted a large quantity of extravaſated blood from the cavity of the thorax, without making any ſuction.

3. It is eaſily apparent, that the two preceding methods take place only when the extravaſated blood is fluid; for if it has concreted into grumes, it will not eaſily eſcape through the mouth of the wound, much leſs will it enter the ſmall orifices of the introduced tube. It is indeed true, that congealed blood ſpontaneouſly diſſolves itſelf in time, but then it alſo putrefies, which is here very prejudicial to the patient: and frequently the anguiſh from the compreſſion of the lungs is ſo great, that one cannot poſſibly wait for this ſpontaneous diſſolution of the congealed blood. In this caſe therefore we inject into the cavity of the thorax warm water, with the addition of ſome honey, venice ſoap, and a little ſalt, (as we directed in the comment on § 236); this liquor being afterwards agitated by the motion of re-

[f] Scultet. Armament. Chirurg. Tab. XII. fig. 9 & 10.
[g] Ibid. Obſerv. 42. pag. 248.

piration, is in a manner blended with the concreted grumes, which are by this means diſſolved, ſo as to be capable of paſſing out with the injected liquor through the mouth of the wound. The injection is to be rendered medicinal, with different ingredients, according as different circumſtances may require. For diluting and diſſolving the concreted blood, warm water will be ſufficient, mixed with a little honey and ſalt; but when the extravaſated blood has already began to putrefy, it will be convenient to uſe an infuſion of ſcordium, rue, horehound, and the like gentle deterging and antiſeptic ingredients.

4. Of this we treated before at § 238.

5. When the wound is of ſuch a nature, that it is impoſſible to diſcharge through it the liquors contained in the thorax, there is then no method left but to make a new opening in a part of the thorax, to which the confined juices have a natural tendency, from the internal figure of its cavity. This method is more eſpecially neceſſary, when the wound is inflicted in the upper part of the thorax; for then it is ſcarce poſſible for the extravaſated blood to paſs out through the orifice of the wound. But ſince the cavity of the thorax deſcends deepeſt towards the back, from the inclined poſture of the diaphragm, therefore the thorax is to be perforated in its back part, as low as can poſſibly be done without danger of injuring the diaphragm, which is attached to the lower ribs, and by aſcending forwards from the poſterior part of the thorax, forms with the bodies of the vertebræ a pretty acute angle. But to avoid injuring the ſtrong muſcles termed *ſacrolumbalis*, *longiſſimus dorſi*, *&c.* which aſcend through the loins and back on each ſide the *ſpina dorſi*; therefore the opening ought to be made at the diſtance of four fingers breadth at leaſt from the vertebræ. The opening is moſt uſually made betwixt the ſecond and third, or betwixt the third and fourth of the ſpurious ribs, reckoning from below upwards.

upwards. But since it appears from anatomy [h], that the diaphragm ascends higher in the right side of the thorax, therefore when the paracentesis of the thorax is made on the right side, it is usually performed betwixt the third and fourth rib: but when on the left side, betwixt the second and third of the spurious ribs, as *Van Solingen* [i] has observed. Perhaps it is for this reason that Hippocrates [k], enquiring which side of the thorax ought to be perforated in the empyema, wished the matter to be lodged in the left side. Dionis [l] also directs to make the opening betwixt the third and fourth rib. Hence an error seems to have crept into the text of this aphorism, when it directs the place for incision to be between the second and third of the true ribs, since in a passage that follows afterwards, the place is directed to be much lower; and in § 1191. numb. 3. treating of the paracentesis of the thorax in the cure of an empyema, the place is directed to be betwixt the fourth and fifth, or fifth and sixth ribs, counting upwards; which is the place that [m] *Ægineta* observes to have been perforated by some in the cure of an empyema, though he presages either sudden death, or an incurable fistula from the operation. I therefore believe that the text ought to be read, *betwixt the second and third of the lower spurious ribs:* unless you will here understand the perforation to be made in the anterior part of the thorax, which may then be certainly the best made betwixt the second and third of the true ribs, counting upwards, as [n] Dionis directs, who only mentions one advantage from making the paracentesis in this part, namely, that the patient can dress his own wound in the absence of the surgeon. But the greater profun-

[h] B. Siegfr. Albini Histor. Musculorum hominis, Lib. III. cap. 81. pag. 300.

[i] Manuale Operatien, &c. tweede deel, cap. 1. pag. 118.

[k] Hippoc. de Morbis, Lib. II. c. 16. Charter. Tom. VII. p. 568.

[l] Dionis Cours d'Operations de Chirurgie, Demonstrat. 5. p. 296.

[m] Æginet. Lib. VI. cap. 44.

[n] Cours d'Operations de Chirurgie, &c. pag. 296.

dity of the thorax backwards, and the natural tendency of the blood towards a low aperture, when the patient is in a supine posture, rather persuade us to prefer the perforation of the thorax in its posterior and lower part. Hippocrates [o], in treating of the cure of an empyema, though he does not directly point out the place to be incised, does yet determine it to be made in the lowest and back part of the thorax. For he says: *At si præ crassitudine & copia (puris) nullum strepitum ediderit, quo illud deprehendatur (fit enim hoc aliquando) utrumlibet latus intumuerit, ac magis doluerit, illud infima parte secare (oportet) à posteriori magis tumoris parte, quam ab anteriori, ut facilis tibi sit puris effluxus. Secare vero inter costas, &c.* "If the matter "should from its thickness and great quantity yield "no fluctuating noise, whereby it may be discove- "red, as is sometimes the case; which ever side is tu- "mified and most painful, there a perforation ought "to be made, rather in the lowest and most back- "ward part of the tumour, then more forward, that "you may have a more easy discharge of the matter. "But to cut betwixt the ribs, *&c.*" And again, speaking of the same disease, he says, [p] *Secare aut urere oportet quam proxime ad septum transversum, cavendo tamen ipsum septum*; "You ought to make "your incision, or apply your caustic as near as pos- "sible to the diaphragm, taking care to avoid that "itself," *i. e.* not to injure it.

In a dropsy of the thorax, where the water is to be extracted, Hippocrates [q] directs to incise down to the bone from the last to the third rib, and then to perforate with a sharp terebra, and after the perforation is made, he orders the water to be extracted by a little at a time, *&c.* From whence it is sufficiently evident, that Hippocrates chose the lowest part of the

[o] De Morbis, Lib. II. cap. 16. Charter. Tom. VII. p. 568.
[p] Ibid. Lib. III. cap. penultimo, pag. 593.
[q] De internis affection. cap. 24. Charter. Tom. VII. pag. 656.

thorax

thorax, in order to extract the contained humours by perforating it.

The place being thus determined, may be eaſily found by counting the ribs, when the patient's body is unclothed: but when the patient is fat, or when an emphyſema attends, this may be more difficult to diſcover; and therefore ſurgeons have endeavoured to determine the part for inciſion by another method. They draw a ſtring ſtraight from the enſiform cartilage to the *ſpina dorſi*, and then divide the ſaid ſtring into three equal parts, and then they determine the place to be two thirds of the length of the ſtring diſtant from the ſternum[r]. Dionis[s] meaſures the diſtance of four fingers breadth from the lower angle of the ſcapula, and at the like diſtance from the *ſpina dorſi* he marks the place to be inciſed. But ſince the ſcapula is moveable, and may change its place by the different actions of the muſcles attached to it, it is evident that this method cannot be always very certain. It will be therefore beſt to examine the part thus pointed out by the fingers, to ſee whether it falls upon the interval betwixt the ribs.

When the part to be inciſed is thus known, it is uſually marked with ink, that it may not be loſt again: But as the ribs are moveable, 'tis very evident, that an alteration in the poſture of the body will alſo change the ſituation of the ſkin. Therefore, Hippocrates[t] juſtly cautions, *Quum vero ſecare aut urere voles, nota impreſſa, fac ut eandem figuram ſervent inter ſecandam aut urendam, ne fallat cutis figuræ mutatione ſurſum vel deorſum vergens*: "That when "you would either inciſe or cauteriſe, making a mark "of diſtinction, cauſe the parts to keep the ſame "poſture during the inciſion or cauteriſation, that the "figure of the ſkin may not deceive you by its ſhift-"ing upwards or downwards." The opening ought

[r] Van Solingen Manuale Operatien tweede deel, cap. 1. p. 118.
[s] Cours d'Operations de Chirurgie, demonſtrat. 5. pag. 296.
[t] De Morbis, Lib. III. cap. penult. Charter. Tom. VII. pag. 593.

next to be made with a knife, or ſome cutting inſtrument, not with a pointed one, as in the paracenteſis of the abdomen, which is made by a ſteel bodkin, included in a ſilver canula; becauſe there would be great danger of wounding the lungs by puncturing in that manner. But in order for a cutting inſtrument to penetrate into the cavity of the thorax, the ſkin, panniculus adipoſus, *latiſſimus dorſi*, and intercoſtal muſcles, with the pleura muſt be divided; to perform which with ſafety, the patient ſhould incline his body a little backward to relax the ſkin, that the ſurgeon may elevate all the common integuments together, with the *latiſſimus dorſi*, if poſſible; and that being thus elevated, he may divide them at one and the ſame time, with a wound ſufficiently large, and of the length of three or four fingers breadth. This done, the patient ſhould incline his body a little backwards, and towards the oppoſite ſide, that the ribs may recede more from each other, and the intercoſtal muſcles be extended; then may the ſurgeon cut through the tenſe intercoſtal muſcles and pleura, with a ſcalpel a little crooked, along whoſe whole back the fore finger is to be applied, and at the ſame time the point of the knife is to be covered with the end of the finger, penetrating carefully into the cavity of the thorax by a ſmall wound, to avoid injuring the lungs: as ſoon as the pleura is divided, the lungs immediately collapſe and recede from the ribs; ſo that then the wound may be ſafely enlarged. But the inciſion is to be made parallel to the ribs, and in the middle ſpace betwixt them, directing the edge of the knife downwards to avoid the intercoſtal veſſels which lie hard by in a hollow ſulcus or groove in the lower margin of the upper rib.

With theſe precautions, this operation may be very ſafely performed; though there are ſtill a few more admonitions which occur in authors regarding the ſame, but which ſeem to be of leſs moment.

Thus

Thus *Fabricius ab Aquapendente*[u] will have it, that the patient ought to breathe out the air at the inſtant of making the perforation through the pleura, that by the receſſion of the lungs from the pleura at that inſtant, they may not be injured by the knife. But at this time of day we know from phyſiology, that the lungs are always contiguous to the pleura, both in expiration and inſpiration, and that they follow the dilation of the thorax. Hippocrates[w] takes notice, that if the matter or water be all of a ſudden diſcharged either by inciſion or cauſtic, from a patient who has an empyema or dropſy of the thorax, it kills him; and therefore ſome would not have all the extravaſated blood extracted at once, but at ſeveral times. Now in an empyema, or in a dropſy of the thorax, the lungs have lain a long time macerating in the matter, or in the extravaſated ſerum flowing all around, ſo that upon diſcharging the whole maſs at one and the ſame time, the lungs might have their weakened veſſels burſt by the ſudden dilatation of them with blood, whence ſudden death. But when this operation is made in wounds of the thorax, it is very rarely that the caſe has been ſo long delayed, as to endanger any thing of this nature; and it appears from many chirurgical obſervations, that all the extravaſated blood has been thus extracted ſuddenly or at once with ſafety. What renders this operation the more eaſily practicable, is the compreſſure of the lungs by the extravaſated humours, and the depreſſure of the diaphragm by their weight, by which means thoſe two organs are not eaſily injured upon perforating the pleura.

It was obſerved in § 297. that the lungs ſometimes adhere to the pleura: now if this ſhould unluckily happen in the place where the paracenteſis is made, I ſay, if the lungs ſhould there adhere to the pleura, it is evident that this will occaſion no ſmall difficulty. Moſt

[u] Operat. Chirurg. cap. 45. pag. 490, 491.
[w] Aphor. 27. Sect. 6. Charter. Tom. IX. p. 263.

of

of the writers in ſurgery, who have treated on this operation, teſtify, that they have met with this accident; and they then direct the ſurgeon to prudently ſeparate the lungs from their adheſions to the pleura with his finger. At leaſt, nothing more can be done than to make trial of this, though it may ſeem cruel thus to lacerate the adhering parts in a living man; but unleſs this be done, the paracenteſis is made to no purpoſe. There is an extraordinary place in Hippocrates[x], which ſeems to point at this. For he there deſcribes the ſymptoms which follow, when (ὁ πλεύμων προσπεσών ἐς τὸ πλευρὸν) *the lungs ſettle to the ribs or ſide*, and which agrees much with the appearances which are obſerved when the lungs adhere to the pleura, after acute or inflammatory diſeaſes of the thorax; and to this alſo the cure which he propoſes for the diſorder, very well agrees. But he afterwards adds: *Si vero ex vulnere illud fiat, aut empyico ſecto (fit enim) huic veſicam fiſtulæ alligans, flatu implere, & intus immittere, & penicillum ſtanneum ſolidum imponere, & ulterius repellere (oportet)*: "But if this happens in a "wound, or in the paracenteſis for an empyema, "you are to introduce a bladder faſtened to a pipe, "and fill it with wind; and you are afterwards to "make a farther ſeparation by a ſolid probe of tin." From which paſſage we may conclude, that in order to ſeparate the lungs from the pleura, Hippocrates introduced a complicated bladder through the wound, which he then inflated, and by the diſtention of the flatus within the cavity of the thorax, forced the lungs from the pleura, to which it adhered. At leaſt, it ſeems to follow, that this ſeparation of the lungs adhering to the membrane of the pleura, was attempted thus early. For fear of this adheſion, ſome adviſe to make a careful inciſion through the intercoſtal muſcles without wounding the pleura, which is then to be diligently examined, to ſee whether any unuſual thickneſs or calloſity of it gives any room to ſuſpect

[x] De Morbis, Lib. II. cap. 23. Charter. Tom. VII. pag. 575.

ſuch

ſuch an adheſion of the lungs to that part; and if ſo, it will be adviſeable to continue the inciſion a little longer, till you come to a part free from this coheſion. But this method of operating is more eaſily ſhewn in a dead body, than it is practicable in a living ſubject, where it ſeems very cruel to make ſuch a ſlow and gradual inciſion. And there are alſo ſuch ample adheſions of the lungs to the pleura ſometimes obſerved, as may even render this method of operating quite fruitleſs. Thus I obſerved in the body of a young nobleman, who died ſuddenly of an apoplexy following an hemopthoë, ſuch an adheſion of the middle lobe of the right ſide of the lungs every way to the pleura, as ſeemed to partition the right cavity of the thorax into two very diſtinct cells. If now in ſuch a condition of the patient a wound was inflicted in the upper part of the right ſide of the thorax, it is then eaſily apparent that the paracenteſis, made in its uſual place, would be of no manner of ſervice. But this is rarely the caſe; and a difficulty hence ariſing ought not to be aſcribed to any default of the artiſt, but to the art, ſince there are no ſigns by which ſuch an adheſion can be previouſly known.

The thorax being thus perforated, all the methods preſcribed in the preceding paragraphs may be then put in practice, to diſcharge the extravaſated blood. But if liquors are to be injected for diſſolving the concreted blood, it will be moſt convenient to convey them in firſt by the inflicted wound, becauſe of its ſituation in a higher part of the thorax, and then they may be eaſily diſcharged together by the new opening, when made.

SECT. CCCIV.

IF theſe wounds are not diſtended with any tents, are ſeldom opened, and ſecured from the air; that air which was admitted may be expelled

pelled by an artificial ſucking, and by proper efforts in reſpiration; and if the cold be alſo carefully avoided, the cure may be then compleated, when practicable, with eaſe and in a ſhort time.

We before propoſed (in § 299.) the reaſons for which the uſe of tents ought to be rejected in wounds not penetrating the thorax; nor do they ſeem to be leſs pernicious in ſuch wounds as penetrate into the cavity of the thorax. But if they are at any time to be uſed, it is when the juices confined in the cavity of the thorax are not to be all diſcharged at once but at different times, which though ſometimes neceſſary in an empyema or in a dropſy of the thorax, according to the admonition of Hippocrates, is very rarely required in wounds of the thorax; but in the former caſes they are inſerted into the wound to admit of a diſcharge of the juices ſtagnating in the cavity of the thorax when it ſhall be thought proper. Even Belloſte [a], who in other caſes almoſt univerſally condemns the uſe of tents as pernicious, does yet allow, that they ought to be uſed for the firſt days after performing the paracenteſis of the thorax to prevent a concretion of the pleura divided in the recent wound. But afterwards they ſeem to be always pernicious, ſince they ſwell or dilate by abſorbing the juices, and rubbing againſt the ſides of the wound by the motion of the thorax, render them callous and more difficult to heal. Some think by the uſe of them to prevent the ingreſs of the air into the cavity of the thorax; but upon the removing the tent at each dreſſing, the air will have a very free ingreſs by the patulent orifice, and its diſcharge will be afterwards prevented by the intruſion of a new tent; ſo that, dilating by the warmth of the parts, it often makes itſelf ſurpriſing paſſages, and may produce the moſt malignant emphyſemata. It is therefore better to cover the mouth

a Chirurgien d'Hôpital, Part. III. Chapit. 6. pag. 228.

of

of the wound only with a flat pledgit, and leave a free paſſage for the humours to eſcape by the opening or wound, which being large, you ought then to be very careful that the pledgit does not ſlip into the thorax, which authors acknowledge has ſometimes happened to the introduced tents. A Daniſh nobleman being wounded, and negligently treated by the ſurgeon, the tent ſlipped into the cavity of the thorax, and was ſix months afterwards diſcharged by the mouth; and yet the patient enjoyed a ſtate of health after this [b]. A man was wounded with a ſword into the right cavity of the thorax near the axilla betwixt the ſecond and third of the true ribs; from which wound blood was diſcharged for the ſpace of fifteen days, and ſome blood was alſo ſpit up by coughing. After many and very troubleſome ſymptoms the wound at length was cicatriſed; but a difficulty in breathing ſtill continued with an inceſſant cough, and a ſpitting of a fœtid and greeniſh matter. Three months being elapſed from the cure of the wound, the patient brought up a couple of tents, with a good deal of matter, which had ſlipped into the thorax from under the emplaſter at different times during the cure of the wound [c].

Another thing required here is to exclude the air from entering through the wound into the cavity of the thorax; or if it has once entered, to diſcharge it from thence. But it is impoſſible to exclude the air ſo long as the extravaſated humours remain there, ſince they require a free paſſage; but when nothing more is diſcharged from the wound, when the air lodged in the cavity of the thorax, betwixt the lungs and the pleura ought to be extracted, and all poſſible care taken to prevent it from entering again. For it appears from phyſiology, that it is neceſſary there ſhould be no air in the cavity of the thorax, in order for the free expanſion of the lungs by inſpiration.

[b] Tulp. Obſerv. Medic. Lib. II. cap. 15. pag. 123, 124.
[c] Hildan. Obſerv. Chirurg. Cent. 1. Obſerv. 46. pag. 41.

Now

Now this discharge of the air may be procured either by sucking, or by the method following, which is the best of any. Let the lips of the naked wound be pressed together by the fingers in such a manner, that no air can enter, and then let the patient draw in a large quantity of air into his lungs by a deep and long inspiration, and let him retain this air as long as he well can: now the air thus retained being rarefied by the heat of the parts, will expand the lungs and compress the air lodged betwixt the lungs and the pleura. If then the lips of the wound are opened or drawn asunder, a great part of the air confined in the thorax will be expelled; after this the lips of the wound are to be immediately closed again, before which the patient must not expire. By repeating this method several times the whole quantity of air may be entirely expelled from the cavity of the thorax, and the patient will directly perceive, that he can breathe much more commodiously. All the air being thus expelled, let a sticking plaister be immediately applied at the instant when the patient retains the inspired air in his lungs; at which time the lungs, being distended and contiguous to the pleura, will obstruct the passage of the air about to enter through the wound. This emplaster is to be continued upon the parts for a very considerable time; and when it is necessary to renew the dressings, another sticking plaister of the like kind is to be applied with the same precautions; and if the seldom dressing of a wound is ever useful, it must certainly be so in these wounds of the thorax. The usefulness of this method is proved by the experiments made on living animals, as described under § 170. numb. 4. For when each side of the thorax was perforated with a large wound, the respiration wholly ceased, and the animal seemed dead; but the intruded air being by this artifice expelled from the cavity of the thorax, the animal revived, and immediately recovered its voice which it had lost.

But

But since all the parts contained in the thorax are near the fountain of heat, the heart, and are continually cherished with a gentle warmth, therefore the utmost caution is to be used to preserve them from the contact of the unusual cold; and therefore a warm air is always necessary here, when the dressings are to be renewed.

By this method wounds of the thorax have been sometimes cured, even though they have been very dangerous, and attended with the most severe symptoms; and that we ought not easily to despair in the worst of them, may appear from the extraordinary observations given us, and of which several such instances were related in § 170, from authors of the best repute. There is doubtless at all times reason to fear much danger in these wounds, since the vital viscera, namely, the heart and lungs, with the largest blood-vessels of the whole body, are here seated: but since even wounds of the heart itself are not always absolutely mortal, (of which viscus Pliny says [d], *quod solum hoc viscerum vitiis non maceratur, nec supplicia vitæ trahit, læsumque mortem illico affert*; "that this "viscus only does not waste with diseases, nor does it "receive life from any other part, and being wounded, produces instant death,") it is evident, that even in the most dangerous wounds there is always some hopes of a recovery remaining; since men have sometimes recovered when they have been left for dead after wounds of the largest vessels, when no manner of care was taken of them, nor any cordials given to strengthen them. It is also not only evident, that the most dangerous wounds of this kind have been cured, but that even in a very short time likewise. A captain had the right side of his thorax perforated with a sword near the axilla, and in a very short time lost seven or eight pounds of blood; nor did the hæmorrhage cease, even though the wound was dressed up with a suitable apparatus; and his

[d] C. Plinii Secundi Natur. Hist. Lib. XI. cap. 37.

pulse

pulse weak and unequal, frequent fainting-fits, a fever, &c. afforded no good presage. The day after, the hæmorrhage not yet ceasing, the patient was obliged to change his place of residence, insomuch that every one believed he would expire in the journey: and yet the wound being only covered with a plaister, the patient was so much relieved by a copious discharge of urine, a spitting of blood, and a profuse sweat on the next night, that all the symptoms vanished, and the wound was in a short time cured barely with an incarnative emplaster, so that on the fifth day after the wound was received, he could ride a horse very well, nor did he from that time any longer keep his bed in the day [e]. Many such instances are to be found in the same author, which teach us, that the most violent wounds of the thorax, attended with the worst symptoms, have been happily cured in a very short time without the use of tents, and with seldom renewing the dressing.

SECT. CCCV.

AND thus all those severe symptoms will be prevented, which we mentioned (301.)

The very worst symptoms which appear after wounds in the thorax, arise almost entirely from the air admitted into its cavity; or from the extravasated juices diminishing its cavity, or else corrupting and injuring the included viscera. When these wounds are not filled with tents, the extravasated blood has a free exit, and the seldom dressing, with the precautions before delivered, will prevent the air from entering, and that which has been already admitted may be expelled by the methods before described. By these means the cure always happily succeeds, unless some part be injured, without the integrity of which life cannot subsist: and it is also from hence appa-

[e] Belloste Chirurgien d'Hôpital, Part. II. chap. 8. pag. 92.

rent,

rent, that the hiſtory and treatment of wounds in the thorax afford much light into ſeveral other diſorders of the thorax and its contained viſcera; as will afterwards appear, when we treat of the empyema and dropſy of the thorax.

Of Wounds in the ABDOMEN.

SECT. CCCVI.

WOUNDS of the abdomen not penetrating into its cavity are diſcovered to be ſuch; 1. by the probe, and by their courſe or ſituation; 2. by injection; and 3. from a knowledge of the nature of the wound, and of the wounding cauſe or inſtrument.

The trunk of the body is divided into two large cavities, of which the upper and leſſer is called the thorax, and the lower and larger the abdomen. But the cavity of the abdomen is divided from that of the thorax by the diaphragm; and therefore all the parts of the trunk below the diaphragm appertain to the abdomen, whether they be parts containing or contained. The whole circumference of the thorax is encompaſſed by the ribs; but the greateſt part of the abdomen is defended only with the ſoft integuments. For if we except the ſuperior and lateral parts of the abdomen on each ſide, which are encompaſſed by the ſpurious ribs, behind which the large liver and ſpleen are ſafely placed, as being the moſt friable or tender of the abdominal viſcera; to which if we add the column of vertebræ occupying part of the abdomen behind, and laſtly the inferior and lateral parts, which are defended by the oſſa innominata on each ſide; excepting theſe, all the other parts of the abdomen are ſoft. As the cavity of the thorax is inveſted on

all ſides with a membrane called the pleura, ſo the cavity of the abdomen is alſo every way lined with a ſimilar membrane, named the peritonæum. And from hence it is, that wounds of the abdomen are in general diſtinguiſhable like thoſe of the thorax: for all wounds injuring the containing parts of the abdomen without dividing the peritonæum, are called not penetrating; as thoſe which perforate the peritonæum are ſaid to penetrate into the cavity of the abdomen. But whether or no wounds thus penetrate, is diſcovered by the following ſigns.

1. Of this we treated in the commentaries on § 300. numb. 2. but in the abdomen the difficulty is ſtill greater, eſpecially in corpulent habits, where the abdomen is covered with a vaſt quantity of fat. From hence it is, that the moſt ſkilful ſurgeons have affirmed, that nothing certain can be diſcovered in theſe wounds by ſearching with the probe; for a change in the ſituation of the parts, a tumour of the lips of the wound, grumes of congealed blood obſtructing the wound, or the fat preſſed into the wound, may hinder the paſſage of the probe when it has been introduced at the mouth of the wound. To theſe add, that the patient is often ignorant of the poſture of body in which he was when the wound was inflicted.

2. As when warm water is injected by a ſyringe at the mouth of the wound: of which we treated in the commentaries on § 300. numb. 4.

3. For if from the figure of the wounding inſtrument, compared with the width of the wound, it ſhall appear to have penetrated deep and in a rectilineal poſition, we may then conclude the wound has paſſed into the cavity of the abdomen; and the reverſe, if from the ſame ſigns the wound ſhall appear to have been inflicted ſuperficially or obliquely. It is eaſily apparent, that a wounding inſtrument may penetrate to a conſiderable depth without perforating the peritonæum in thoſe who have their belly prominent with fat to the thickneſs of half a foot.

SECT.

SECT. CCCVII.

IF theſe wounds penetrate almoſt as deep as the peritonæum, the integuments being there weakened, may give occaſion for a hernia to be formed in a robuſt patient; than which nothing can be worſe, if the fiſtulous wounds run obliquely betwixt the integuments of the abdomen.

To what a degree the peritonæum may be extended is ſufficiently evident in women with child, and in thoſe afflicted with dropſies; from whence wounds, not penetrating the abdomen, have a circumſtance peculiar to themſelves, which being neglected has often produced a train of the worſt conſequences. For the diaphragm being depreſſed at every inſpiration, all the contents of the abdomen are thereby compreſſed, and again in exſpiration they are repreſſed by the abdominal muſcles; whence it is evident, that the contents of the abdomen receive a continual preſſure from the diaphragm and muſcles of the abdomen. If therefore the equality of this preſſure be removed in any part by a wound in the integuments extending almoſt to the peritonæum, that membrane being eaſily dilatable, will be extended by the force of reſpiration ſo as to form a ſacculus, into which the inteſtines, omentum, *&c.* may enter, and form an hernia, which is no more than a dilatation of the peritonæum in ſome part, into which the contained viſcera of the abdomen may prolapſe or enter. For it is very rarely, if ever, that an hernia is formed by a rupture of the peritonæum, but almoſt conſtantly from an expanſion of that membrane into a ſacculus; notwithſtanding Celſus [a] ſeems to have been of another opinion: and we are taught by moſt certain obſervations, that ruptures may be formed in any part of the abdo-

[a] Lib. VII. cap. 4. pag. 413. & ibid. cap. 17. pag. 454.

men where the equable preſſure is removed from the peritonæum. In the dead body of a woman, an hernia was found on the left ſide of the linea alba, four fingers breadth above the navel, and which contained a portion of the omentum and inteſtinum colon. This rupture aroſe from a violent blow received on this part of the abdomen [b]. Sennertus [c] relates a wonderful caſe, which teaches us, that a weakneſs in any part of the abdomen may occaſion very large hernial tumours. A cooper's wife, in helping her huſband to bend one of the ſtaves, was by the return of it ſtruck on the left inguen. A ſmall tumour aroſe ſoon after in the part, which in a little time increaſed greatly; it afterwards appeared, that the increaſing uterus of this unhappy woman, big with child, had got into a large ſack formed by a dilatation of the integuments of the abdomen; in which place the motion of the living fœtus might be perceived both by the eye and touch: and as there ſeemed to be no other remedy left at the time of birth, the infant was delivered alive by the cutting open of the womb; at which time Sennertus being preſent ſaw, that the peritonæum was not ruptured but entire, only conſiderably dilated by the bulk of the womb. After the cure of a wound in the abdomen, a conſiderable hernia was formed in the part where the wound had been made, which neglected by the man, he ſix years afterwards died of a gangrene in that part [d]. Now the ſtronger the perſon thus wounded is, the more liable is he to a future rupture there, becauſe the preſſure acts ſo much the ſtronger on the reſt of the abdomen, whereby the weaker place will be more eaſily and ſpeedily dilated. To which add, that ſtrong bodies are uſually employed in violent exerciſes, whence the leaſt reſiſting parts will be again more dilated by the greater efforts of reſpiration.

[b] Acad. des Sciences, l'an 1714. Mem. pag. 259.
[c] Lib. IV. part. 1. ſect. 2. cap. 16. Tom. III. pag. 39.
[d] Tulp. Obſervat. Medic. Lib. III. cap. 20. pag. 211.

Than

Than which nothing can be worſe, *&c.*] It is well known that a large quantity of fat is always ſeated upon the abdomen, unleſs the perſon is very lean; and this fat is not only ſpread upon the muſcles of the abdomen, but is alſo interpoſed every where betwixt them: if therefore a wound ſhould run obliquely betwixt the integuments of the abdomen, the extravaſated humours or matter there collected, and not meeting with a free diſgrace through the mouth of the wound from ſome impediment, often burrows or makes its way ſurpriſingly through the ſubſtance of the panniculus adipoſus, and forms deep ſinuoſities betwixt the interſtices of the muſcles, in which caſe the cure becomes extremely difficult; and frequently it is even wholly impracticable to cure theſe fiſtulous ulcers following from wounds of the abdomen, ſince it is there neceſſary either to compreſs the bottom of ſuch a fiſtula by an artificial preſſure, while its aperture continues open; or elſe to lay open all its mæanders by inciſion. But that both thoſe methods are often impoſſible to be uſed in theſe caſes will readily appear to any one who conſiders the great thickneſs of the adipoſe membrane there, and the interpoſition of it betwixt the interſtices of the abdominal muſcles. Celſus [e] takes notice of theſe very bad fiſtulæ being formed here, when he ſays, *Ventri nullum os ſubeſt; ſed ibi perniciosæ admodum fiſtulæ ſunt: adeo, ut Soſtratus inſanabiles eſſe crediderit. Id non ex toto iter ſe habere uſus oſtendit*; "There is no bone placed "under the abdomen; yet there are very bad fiſtulæ "ſeated there, inſomuch that Soſtratus believed them "incurable. But that they are not always incurable, "experience demonſtrates."

But Celſus chiefly believed fiſtulæ of the abdomen to be dangerous, becauſe being laid open they occaſion ruptures; and therefore he ſays [f], *Tutior fiſtula eſt contra jecur et lienem et ventriculum, quam contra inteſtina; non quo perniciosior ibi res ſit, ſed quo alteri*

[e] Lib. VII. cap. 4. pag. 413. [f] Ibidem.

periculo locum faciat; "A fiſtula ſeated oppoſite to "the liver, ſpleen or ſtomach, is leſs dangerous than "one oppoſite to the inteſtines; not that the effects "are there worſe in themſelves, but becauſe they "there make way for another diſorder." Tulpius [g] laments an incurable fiſtula in a girl, which aroſe by a long and winding courſe from one of the ſpurious ribs which was carious. Many more of theſe caſes have been obſerved, of which we ſhall ſpeak more largely when we come to treat on fiſtulæ; it will be ſufficient at preſent to produce one or two inſtances. A captain received a wound at the diſtance of two fingers breadth from the navel by a ſword, which penetrated upwards and backwards: as the wound did not penetrate the cavity of the abdomen, it was only covered with a ſingle and flat pledgit and a plaiſter, ſo that on the next day it was cloſed. The abdomen was wonderfully painful and ſwelled for ſix days afterwards; but by the uſe of phlebotomy and the application of emollient fomentations to the abdomen, the pain was abated, and the next day a ſmall prominent tumour appeared in the place of the wound, which being opened, diſcharged an incredible quantity of matter, and was perfectly cured in the ſpace of eight days [h]. In another wounded patient, the ſword entered the epigaſtrium at the diſtance of two fingers breadth from the linea alba: and as the ſword was flat and eaſily flexible without breaking, it went according to the courſe of the ribs quite to the vertebræ of the back, from whence a fiſtulous ulcer was formed, the bottom of which being opened, a happy cure followed [i].

[g] Obſerv. Medic. Lib. III. cap. 28. pag. 230, 231.
[h] Traité complet de Chirurgie, par Mr. de la Motte, Tom. III. pag. 97. [i] Ibid. 108—113.

SECT.

SECT. CCCVIII.

THerefore in theſe wounds recourſe muſt be had to ſuture and bandage: and then in other reſpects, the treatment uſual in common wounds will ſuffice.

What has been ſaid of the cure of wounds in general is applicable to theſe, and will be ſufficient for the cure, if there is no danger of ruptures or fiſtulæ. Narrow and deep wounds of the integuments eaſily degenerate into fiſtulæ; and therefore care muſt be taken by an artificial preſſure and a proper poſture of the patient to prevent the confined humours from forming ſinuſes in the panniculus adipoſus. But the broader ſort of wounds in the integuments very much endanger ruptures, whence it will be proper to unite them by ſuture, (ſee § 214.) and to ſecure the weakened part by an artificial application of compreſſes and bandages, that the contents of the abdomen being preſſed there may not dilate the peritonæum. But ſince every ſtrong effort in reſpiration is here very pernicious, therefore every thing which occaſions the perſon to breathe ſtronger than uſual ought to be ſtudiouſly avoided: and more eſpecially care muſt be taken not to retain inſpired air by ſhutting the larynx, as is done for example in diſcharging the fœces of the inteſtines, eſpecially when a ſtrong effort is required to expel the indurated fœces. Therefore the bowels are to be cleanſed with an emollient clyſter, and then the diet ought to be of ſuch food as affords the leaſt quantity of groſs fœces to be collected in the inteſtines; ſuch, for example, is the broth of fleſh, with which alone life may be ſupported, and yet the patient may without damage continue a month without going to ſtool, becauſe there are ſcarce any fœces thence accumulated in the inteſtines. For the ſame

reaſon the urine ought alſo to be retained for a conſiderable time, that it may be diſcharged almoſt ſpontaneouſly and with little or no ſtraining. If any cough ſhould attend, that muſt be appeaſed with diacodiates: laughing, calling out aloud, ſneezing, and the like, are to be avoided as much as poſſible: and for the ſame reaſon abſolute reſt ought to be ordered to the patient.

SECT. CCCIX.

BUT that ſuch a wound penetrates into the cavity of the abdomen will appear, 1. by the probe, and poſture of the patient: 2. by injections: 3. by a knowledge of the wounding inſtrument and nature of the wound: 4. by the egreſs of the contained parts.

We have already treated of the ſigns compriſed in the three former numbers of this aphoriſm, at § 306. and § 300. numb. 1, 2, 4.

4. If thoſe parts which we know are contained in the cavity of the abdomen come out through the wound, no doubt can then remain, but the wound has certainly penetrated into the cavity of the abdomen. But more eſpecially the omentum and inteſtines fall out, when the abdomen is perforated. It is eaſy to diſcover when the inteſtines are prolapſed, but in corpulent people, the fat being free from the preſſure of the divided ſkin, often protuberates through the mouth of the wound, and reſembles the fat of the omentum, which may occaſion an error in the diagnoſis of a wound. At the ſame time alſo a wound penetrating into the cavity of the abdomen may be ſo obſtructed or cloſed by this protruſion of the fat, that neither the probe nor the injection of warm water can diſcover that it penetrates. If in ſuch a wound there is a diſcharge of any of the humours belonging

to

to the abdominal viſcera, as blood, urine, bile, &c. of which we ſhall treat in § 312. this is an evident ſign, that the wound not only penetrates the cavity of the abdomen, but has alſo injured ſome of the parts therein contained.

SECT. CCCX.

BUT if all the ſymptoms are ſlight, without pain, fever, or inflammation, no blood comes from the wound when the patient lies upon it, and the injected liquor returns unaltered in its colour, we then know that the internal parts are not injured.

After the ſigns make it evident, that the wound has penetrated into the cavity of the abdomen, the next enquiry muſt be, whether or no any of the viſcera or veſſels contained in that cavity have received any injury. But ſince all the viſcera conduce to health by their functions, it will immediately appear, that if no great diſturbance of the functions can be obſerved depending on the continuity of thoſe viſcera, that no part of any moment is injured in the abdomen. And as the abdominal viſcera are principally ſubſervient to chylification, therefore if the retention and converſion of the aliments into chyle, the abſorption of that, and the expulſion of the remaining fœces, are performed as they uſually were in health, we may be certain that the wounding inſtrument has not injured any of the abdominal viſcera, notwithſtanding its having penetrated into the cavity of the abdomen. But as the organs, which ſerve for the ſeparation and diſcharge of the urine and to generation, are (with ſome impropriety, becauſe ſeated without ſide the peritonæum) ſaid to be ſeated in the abdomen; therefore enquiry muſt be made, whether

any of the ſymptoms conſequent on the wound demonſtrate that theſe parts are injured.

Beſides theſe injuries of the abdominal viſcera, it ſometimes happens, that barely a diviſion of the nerves in the meſentery produces the moſt dangerous ſymptoms, and even death, as we obſerved from Ruyſch in the comment on § 170. numb. 3. but in that caſe the intenſe pain, fever, and inflammation, ſufficiently declare the danger that is preſent. Therefore if theſe ſymptoms are abſent, there is all the reaſon imaginable to expect a happy cure. But alſo the large veſſels, which convey blood, chyle, and lymph, may be injured by wounds in the abdomen; and therefore if the patient lies upon the wound, ſufficiently large or open, and no blood or other juice is diſcharged, we thence know that thoſe veſſels are not injured; but as extravaſated blood may congeal, and remain in the cavity of the abdomen without running out through the wound, therefore the ſurgeon injects warm water with a ſyringe at the mouth of the wound, which returning unaltered, nothing of this nature can be feared. But it muſt be remarked, that in an healthy living perſon the cavity of the abdomen is always full of moiſt vapours, which appear very manifeſtly upon opening the belly of an animal juſt killed: and theſe being condenſed by the cold of the air admitted, or by any other cauſe, may flow from the wound in form of a condenſed and collected lymph, though none of the internal veſſels are injured.

SECT CCCXI.

THE air muſt be immediately excluded, and that which entered muſt be expelled by ſucking and the effort of expiration; the integuments are then to be ſewed together by the operation termed gaſtroraphia, laying aſide the uſe of tents; and thus the cure of the wound will be compleated

compleated by dreſſing ſeldom and with vulnerary balſams, and by the patient's lying upon the wound, keeping to a ſpare, moiſt, and healing diet, with reſt of body.

The air muſt be excluded, *&c.*] When it appears from the ſigns before deſcribed, that none of the contained parts in the abdomen are injured, ſuch a wound then requires to be immediately healed up. But it is to be obſerved, that the air will ſometimes enter through the wound, and being retained in the cavity of the abdomen, it may be there greatly rarified and expanded by the heat, ſo as to compreſs all the viſcera, if it be hindered from eſcaping again through the wound. Now from this air inſinuating itſelf into the panniculus adipoſus may ariſe wonderful emphyſemata, as we obſerved in wounds of the thorax at § 300. numb. 5. Therefore before the conſolidation or cloſing of ſuch a wound is attempted, one ought to be ſatisfied, that no air remains in the cavity of the abdomen; and if there is any there, it muſt be firſt diſcharged in the manner we directed in § 304. namely, by letting the patient retain the inſpired air as long as he well can, and then to make a ſtrong effort of expiration while the larynx is ſhut; for thus the contents of the abdomen will be ſtrongly compreſſed by the deſcent of the diaphragm and contraction of the abdominal muſcles during the niſus of expiration, and thus the confined air will be expelled through the mouth of the wound. But to prevent the omentum or inteſtines from being forced out at the ſame time, the wound may be covered with a piece of open linen, which will tranſmit the air and reſtrain the other parts from coming out.

The air being thus excluded, it is then required, by the general indications for the cure of all wounds (§ 185. numb. 3.) to unite again the parts which have been ſeparated by the wounding inſtrument, and to retain

retain them in that union; and this is performed in wounds penetrating the cavity of the abdomen by a particular method, namely,

By ſewing together the integuments.] This operation has been long ago deſcribed by the antients, who ſeem to have attempted it different ways. Galen [a] fearing leſt the divided lips of the peritonæum ſhould not conjoin with each other, becauſe he judged a membrane to be nervous and bloodleſs, would therefore have this operation performed ſo, that the divided lips of the peritonæum might unite with the oppoſite ſides of the wounded lips of the abdomen. For he orders the needle to be carried from without inwards through the ſkin without perforating the peritonæum, and then with the ſame needle he ſews the peritonæum, with all its incumbent integuments, to the oppoſite ſide of the wound; which done, he afterwards paſſes the needle through the ſame ſide of the wound from without inwards, perforating the ſkin and muſcles again without touching the peritonæum; and then again, on the oppoſite ſide he perforates the peritonæum, and ſews it to all the incumbent integuments, by paſſing the needle from within outwards. By this method he endeavoured to cauſe the divided peritonæum to unite with the oppoſite ſide of the divided abdominal muſcles. But there is ſtill another method propoſed by Galen in the ſame place for performing the gaſtroraphia, by which the parts are united and conſolidated each with its fellow; *viz.* the peritonæum with the peritonæum, and the muſcles with the muſcles, *&c.* and which therefore ſeems to be the better method of the two. Celſus [b], in deſcribing this operation, orders it to be performed, ſo as to make the future firſt upon the moſt internal membrane; and that being done, to paſs the ſame needle and thread through the ſkin, and to unite the lips of the wound by future in the

[a] Meth. Med. Lib. VI. cap 4. Charter. Tom. X. pag. 140, 141.
[b] Lib. VII. cap. 16. pag. 453.

ſame

ſame manner: for, ſays he, neither the ſuture of the ſkin, nor of the peritonæum, will be ſufficient alone, but both are neceſſary. He would alſo have the ſuture performed with two threads, and thicker than are uſual in other wounds; becauſe they may be more eaſily broke by the motion of the abdomen, and becauſe the parts here are not expoſed to ſo great an inflammation. In making this ſuture it is principally required to give the patient as little pain as poſſible, and to avoid injuring either the omentum or inteſtines; nor is there any danger of the ſuture being torn open by the continual motion of the abdomen. But ſince the ſkin of the abdomen is very tough and difficult to perforate, as all thoſe have experienced who have ſewed up the abdomen after it has been opened in dead bodies; therefore it is required to have the needles very ſharp pointed, and with cutting edges, extending to about a third part of the length of the needle, which is to be ſo far crooked, and the remainder ſtrait. The thread muſt be ſtrong, or elſe ſeveral times doubled, not twiſted together, but diſpoſed in the ſame plain, the extremities of which are to be paſſed through the eyes of two of the forementioned needles; and then the point of one needle, being concealed by the fleſh of the fore-finger, is to be cautiouſly conveyed under the peritonæum in the cavity of the abdomen to avoid injuring the omentum or inteſtines; then let the peritonæum and integuments be perforated, by paſſing the needle at about the diſtance of a finger's breadth from the edge of the wound. In the ſame manner let the oppoſite lip of the wound be perforated with the other needle, and the thread, being drawn through, is to be afterwards tied in a knot upon ſmall compreſſes firſt placed underneath for that purpoſe. In this manner is the ſuture to be repeated according as the length of the wound requires. What elſe is neceſſary to be obſerved in performing the operation of gaſtroraphia may

may be seen in Garengeot [c] and the other writers on operations; see also what has been said in the commentary on § 214.

The use of tents is to be laid aside.] For these are in this case pernicious, since the divided parts require to be united, which union will be always impeded by the interposition of any foreign body. But the pernicious consequence of using tents in wounds of the abdomen has been shewn both from reason and experience by Belloste [d].

By the patient's lying upon the wound, and dressing it with balsam, *&c.*] since the union of the lips of the wound requires them to be brought together by suture, their consolidation may be procured barely by dressing with a small quantity of some vulnerary balsam, or the application of a small pledgit moistened with the like balsam, agreeable to what we observed under the cure of wounds in general § 204. But the posture of the patient is required to be such, that the matter and other extravased juices may have a natural tendency to be discharged from the wound, which must therefore be laid upon. Absolute rest is here required, because motion of the body, coughing, laughing, sneezing, or difficult going to stool, augments the force of respiration, so as to endanger a laceration of the suture; or at least those violent motions of the abdomen would distract the threads and irritate the conjoined parts, whence inflammation, pain, and their bad consequences may follow. For those reasons also a moistening and mild diet is necessary to be taken in a small quantity at a time, to avoid a repletion and distention of the stomach and abdomen; flesh broths are principally recommended here as we observed in the commentary on § 308. If now neither pain, itching, nor inflammation, *etc.* follow, seldom dressing of the wound will hasten the

[c] Traité des Operations de Chirurgie, Tom. I. pag. 124, *&c.*
[d] Chirurgien d'Hôpital, Part. II. chap. 15. pag. 114, *&c.*

cure,

cure, as we said before in the cure of wounds in general.

SECT. CCCXII.

BUT if the pain is acute, and there are signs of a fever or inflammation or if the wound discharges blood, ichor, food, drink, or chyle; or else if it discharges matter, bile, urine, or fœces, with a stench; in these cases, by considering the wounding instrument with the situation and nature of the wound, the paleness, inquietude, faintings, cold sweats, and deficient pulse in the patient; all these will indicate, that some, and which of the abdominal viscera are injured.

Hitherto we have considered wounds of the abdomen, which either injure the common integuments only, the peritonæum remaining entire, or which penetrate into the cavity of the abdomen, but without injuring any of the contained viscera or vessels. We come now to those signs, by which we know, that some of the contained parts of the abdomen are injured; and from which signs may be concluded what parts contained in the cavity of the abdomen have been wounded. But all these signs are either taken from, the matters discharged through the wound, or else from the injured functions.

Acute pain.] This is a symptom highly to be suspected in wounds of the abdomen, denoting, that some of the membranous or nervous parts are injured. But how dangerous injuries of these parts are, may appear from what has been said in § 170. numb. 3. where it is evident from the observations of Ruysch, that wounds inflicted on the mesentery, without injuring any other parts, have produced the most excruciating pains of the abdomen, and proved fatal within two or three days; it also appears very probable,

ble, that all these symptoms follow from the injured nerves in the mesentery. Celsus [b] enumerates among the signs of a wound in the liver, shooting pains extending to the throat, and very severe where the neck is joined to the scapula of the same side. In wounds of the kidneys he observes, that the pain descends to the groins and testicles: and the parts of generation in the female being wounded, he says excite a pain in the groins and hips.

Fever.] Which if it does not arise from a disturbance of the mind in the wounded patient, is always the consequence either of severe pain or inflammation, which must be always very dangerous in these nervous parts, as the mesentery, intestines, *&c.*

Inflammation.] The signs of which are, a shivering, and the feverish heat which follows, with thirst, anguish, difficult respiration, a hard pulse, dry tongue, *&c.* But how fatal an inflammation is in most of the abdominal viscera, we are taught by the iliac passion and hernia incarcerata, in which diseases even the most robust people perish in a few hours time.

Blood.] Which denotes that some of the larger blood vessels are injured, and that it is arterial, if it is discharged impetuously and of a very florid colour; but venal, if it appears of a darker colour.

Ichor.] Such a thin liquor may be discharged from various parts injured by the wound penetrating the abdomen. There are here a great many lymphatic vessels, which may discharge such a juice; or if the pancreatic duct, porus hepaticus, or pelves of the kidneys are wounded, they may discharge an incredible quantity of such an ichor into the cavity of the abdomen. Even the vapours, which repleniſh the cavity of the abdomen in an healthy animal, being discharged from the perspiring vessels, and condensed by the cold of the air admitted through the wound, without being absorbed again by the veins, will be here collected, and often discharged in a very consi-

[b] Lib. V. cap. 26. pag. 286.

derable

derable quantity from the mouth of the wound, when none of the internal parts are injured.

Food and drink.] Theſe denote that the ſtomach is injured; wounds of which are always dangerous, but not abſolutely mortal; as appears from what has been ſaid in the commentary on § 170. numb. 5. to which we may add the inſtance related in the miſcellanea curioſa [b], of a man, whoſe ſtomach being wounded, and the lips of the wound becoming callous, did not unite, but part of the food and drink were diſcharged through the opening of the wound during the ſpace of eleven years.

Chyle.] If this is diſcharged through the wound, it denotes, that the ſmall inteſtines are injured, or that the chyliferous ducts are wounded, in which latter caſe the colour of the chyle is much whiter, whereas the chyle of the ſmall inteſtines always appears more of a grey or aſh colour, and when the ſmall inteſtines are wounded near the ſtomach, where the bile mixes itſelf, the chyle appears then of a yellowiſh colour.

Bile.] Which denotes an injury either of the common or cyſtic duct, or of the duodenum wounded in or near that part where it receives the common duct; but more eſpecially a large quantity of bile is diſcharged from the cavity of the abdomen when the gall bladder itſelf is wounded. There is a very remarkable caſe of this nature related in the philoſophical tranſactions [c], of an officer, who received a wound penetrating the cavity of the abdomen, and entering the bottom of the gall bladder, without offering any conſiderable injury to the other adjacent parts. The ſymptoms which followed this wound were ſurprizing enough, for the abdomen was immediately diſtended, as if the patient had been afflicted with an aſcites or tympanites, nor did the ſwelling either increaſe or diminiſh till the patient's death, which happened a week after the infliction of the wound. There were

[b] Decad. 2. Ann. 5. pag. 2.
[c] N° 414. pag. 341. Abridgm. Tom. VII. pag. 571, 572.

no belchings, flatus, or rumbling noiſe, and the bowels continued ſtrictly conſtipated during the whole time, notwithſtanding ſtrong purges and clyſters were uſed. The patient had ſcarce any ſleep, even though opiates were given in a very conſiderable doſe. The wound appeared externally pale, flaccid, and without matter. The pulſe was ſtrong, equal, and ſlow, but the day before death it was ſometimes a little intermitting, and the patient's ſenſes continued even till death; a ſlight hiccup and nauſea attended the fifth day after the wound was inflicted. From this hiſtory it is evident, that a diſcharge of bile from a wound of the abdomen is a very bad ſign.

Matter.] Which denotes a ſuppuration made in the internal parts from the inflicted wound, unleſs perhaps the patient ſhould have had a purulent vomica before, which the wounding inſtrument has now opened.

Urine.] Which being diſcharged from the wound, ſignifies, that the pelvis, ureter, or bladder is injured, as any one may readily perceive.

Fœces or ſtench.] It appears from phyſiology, that the ingeſted aliments are by degrees ſo drained by the action of the ſtomach and ſmall inteſtines, (the more fluid parts being abſorbed by the bibulous mouths of the meſeraic and lacteal veſſels,) that towards the end of the inteſtinum ilium ſcarce any thing more than the inſoluble fœces remain, which ſlip into the inteſtinum cæcum, from whence they are by degrees protruded through the whole length of the colon to the rectum, where they make their exit. Now it has been obſerved, that no ſtench (which is the ſign of incipient putrefaction) is perceptible in thoſe relicts of the chyle, unleſs in the cæcum, colon, and rectum; but never in the ſmall inteſtines. For this reaſon Helmont [d] ſays, *ſedere ſtercoreum fermentum, corruptionis opus, non nutritionis*; "that a ſtercoraceous fer-"ment is ſeated in the inteſtinum cæcum, not for

[d] Ortus medicin. pag. 179. n° 81. in fine capituli: *Sextuplex digeſtio alimenti humani.*

"the

" the buſineſs of nutrition but putrefaction." When therefore the fœces are diſcharged through the wound, or when their fœtid ſmell is expired through the wound, we may conclude that the large inteſtines are injured. Hence Celſus [e], after ſaying that a wound in the ſtomach and ſmall inteſtines have the ſame ſigns, he adds, *cætera inteſtina icta vel ſtercus, vel ejus odorem exhibeat*; " that the other inteſtines being wound-" ed, either diſcharge the fœces or their ſmell.

The wounding inſtrument, with the nature and ſeat of the wound.] If the inſtrument can be obtained with which the wound was inflicted, by comparing it with the width of the wound, it will often indicate how far the wound has penetrated: It is alſo evident, that the nature of the inflicted wound varies much according to the different direction in which the wounding inſtrument entered the cavity of the abdomen, either upward, downward, laterally, *etc.* alſo the ſituation of the abdomen and viſcera may differ much according to the different poſture of body which the patient was in at the time when he received the wound, and alſo according to other different circumſtances. Thus the very accurate anatomiſt, Winſlow, has obſerved [f], that the liver in the human body is ſo firmly attached by its ligaments, that it cannot eaſily ſlip from one ſide to the other; yet that it is not abſolutely ſuſpended by them, but is in part ſuſtained by the ſtomach and inteſtines, eſpecially when they are full. Hence after long faſting, the liver deſcending by its own weight, pulls down the diaphragm, and occaſions an uneaſy ſenſation, which the ſame anatomiſt thinks is unjuſtly aſcribed to the ſtomach. Therefore if a man be wounded when the ſtomach is empty and in an erect poſture, at the diſtance of about two fingers breadth under the falſe ribs on the right ſide, in that caſe the liver may be injured, as it deſcends below the margin of the ribs; and of this na-

[e] Lib. V. cap. 26. pag. 287. [f] Expoſition Anatomique, &c. Traité du bas ventre, n° 267, 268. pag. 350.

ture we have an inſtance related by Garengeot [g] of a man who died of ſuch a wound, upon opening whoſe body an abſceſs appeared in the liver from this cauſe. The ſame is alſo true of the ſtomach, which when full frequently deſcends to a conſiderable degree.

Paleneſs, cold ſweat, inquietude, fainting, and deficient pulſe.] All theſe ſigns denote a deficiency in the vital powers, and generally follow a great loſs of blood; therefore when theſe ſigns appear without any flux of blood externally from the wound, we ought then to think of an internal hæmorrhage, and conclude that the large blood-veſſels are injured: for the blood being thus extravaſated within the cavity of the abdomen returns only in a ſmall quantity to the heart, whoſe force will be therefore diminiſhed, whence the pulſe begins to weaken, intermit, and at length wholly ceaſes in a perfect ſyncope. Hence paleneſs from a collapſion of the empty blood-veſſels, and a cold ſweat, which are certain marks of weakneſs in the vital powers. Then begins that ſtruggle of life with death which is commonly called an agony, namely, extreme anguiſh and inquietude, ſo that they are continually changing the poſture of their body ſo long as their ſtrength will permit, and at length a deliquium or death itſelf follows. Conſult what has been ſaid in the commentary on § 302. numb. 7.

Sometimes perhaps theſe ſymptoms may ariſe from an injury of the nerves, which are diſperſed through the viſcera of the abdomen. For that theſe nerves have a very great influence upon the vital functions, we are taught by ſudden deaths which follow from the inverſion of an inteſtine, or incarcerated rupture, *etc.* even in the moſt healthy and robuſt people; in which diſorders all theſe ſymptoms appear, and are often followed with death in a few hours. Hence Celſus [h], enumerating the ſigns of a wound in the

[g] Traité des Operations de Chirurgie, Tom. I. pag. 84.
[h] Lib. V. cap. 26. pag. 287.

ſtomach,

ſtomach, ſays, *Venarum motus elangueſcunt, ſudores tenues oriuntur, per quos extremæ partes frigeſcunt*; "That the pulſe languiſhes, and thin ſweats ariſe, in "which the extremities grow cold." And immediately afterwards he adds, that the ſigns of a wound in the ſtomach and inteſtines are the ſame.

From all theſe ſigns we know, that the parts contained in the cavity of the abdomen are injured, and frequently it is ſufficiently evident from the ſame ſigns, which of the contained parts are affected; ſo that from hence we have a diagnoſis of theſe wounds, and in the following aphoriſm we are taught their prognoſis.

SECT. CCCXIII.

THEN follow an infinite number of diſorders, partly 1. from the nature of the viſcera, which are not muſcular, but compoſed of thin veſſels, in which the circulation is difficultly performed, and not unleſs the abdomen be entire; 2. from an injury of the function of the viſcus; 3. from the quantity and putrefaction of the extravaſated blood; 4. from the preſſure, rarefaction, and injury received from the air, which has entered through the wound.

1. It appears from phyſiology, that all the abdominal viſcera, which are ſubſervient to chylification, tranſmit all their venal blood to the ſinus of the vena portæ, which immediately after divides and diſtributes all the received blood throughout the whole maſs of the liver in ſuch a manner, that the blood no longer flows from ſmall to larger branches, but from a broad baſis to a narrower, as in the arteries. Hence it is evident that the circulation of the juices muſt be here very difficult, ſince the venal blood having loſt the greateſt part of its motion, which it re-

ceived from the heart and arteries, is here again obliged to pafs through the narrow and converging veffels of the liver. But then this circulation of the juices is promoted by the action of the diaphragm and abdominal mufcles, which prefs alternately upon all the abdominal vifcera: for at the time of inſpiration the diaphragm deſcends downward, and diminiſhes the cavity of the abdomen compreſſing all the contained parts, but at the time of expiration the muſcles of the abdomen contract and re-act in the ſame manner upon the viſcera. Hence the circulation of the blood is promoted through the abdominal viſcera every moment of life by theſe alternate preſſures, and from hence ſo frequently ariſe obſtinate obſtructions about the liver, ſpleen, and other viſcera of the abdomen, in ſuch people as, leading a ſedentary and unactive life, neglect the healthy exerciſes of body, and from whence follow many of the moſt obſtinate chronical diſorders. When therefore this action of the diaphragm and abdominal muſcles is diſturbed or removed by a wound, it is evident, that this preſſure will be wanting, which is required to promote the circulation of the juices through the abdominal viſcera. This appears evidently in the diſſection of living animals; for when the abdominal muſcles are divided by tranſverſe inciſion, all the veins of the abdominal viſcera will in a few minutes time appear very much diſtended, becauſe the venal blood cannot obtain a free courſe through the ſmall veſſels of the liver for want of this action of the abdominal muſcles. In the mean time it is very evident, that this bad conſequence is not to be expected from all wounds of the abdomen, but only from thoſe which conſiderably injure the action of the diaphragm or abdominal muſcles. Add to this, that the air ruſhing in through large wounds, may by the coldneſs of it, to which the abdominal viſcera are unaccuſtomed, very much injure them, and from theſe two cauſes may be deduced

duced the reaſon why the omentum or inteſtines ſo eaſily mortify when they prolapſe through a wound.

2. Each of theſe viſcera have their particular uſes ſubſervient to the buſineſs of chylification, and therefore an injury offered to one or more of them will diſturb the formation of the chyle. Thus for example, if one of the ſmall inteſtines be divided near the pylorus, all the chyle will eſcape into the cavity of the abdomen, or be diſcharged through the wound, the body will be defrauded of its nouriſhment, and the patient will periſh by a true maraſmus. A wound of the gall bladder will extravaſate that important juice into the cavity of the abdomen, as in the caſe we related under the preceding aphoriſm, whence the bowels will remain obſtinately bound up, without being relieved by any medicines, accompanied with a ſudden and laſting inflation of the abdomen, which are conſequences that one would not eaſily foreſee to happen from ſuch a wound. Hence it is alſo evident, how neceſſary the action of the bile is towards that of moſt of the abdominal viſcera. But the bile is formed from the venal blood coming from all the chylificative viſcera, and perhaps of a different nature in each, being alſo wonderfully changed by the ſtructure of the liver itſelf; whence an injury of the abdominal viſcera frequently deſtroys ſomething neceſſary to the ſecretion of good bile; and the bile therefore degenerating from its healthy or natural ſtate, the formation of the chyle may be wonderfully diſturbed. Thus the liver and ſpleen appear like a ſponge full of blood, and therefore a quantity of blood being extravaſated from a wound in either of theſe may produce inflammation, ſuppuration, or a converſion of thoſe viſcera into corrupt matter, *etc.* as one may reaſonably expect.

3. A diviſion of the blood-veſſels, which are diſtributed in ſuch numerous and large branches through the viſcera of the abdomen, may evidently extravaſate a large quantity of blood into the cavity of the

abomen, where it may be injurious by its weight compreſſing the viſcera, and alſo by its putrefaction, eſpecially if the air is alſo freely admitted at the ſame time. But a ſmall quantity of extravaſated blood, without any conſiderable injury of the important viſcera, is not judged very dangerous by Ruyſch [a], who made experiments of this kind on living animals, eſpecially if the free acceſs of the air is prevented; for that anatomiſt having firſt tied the ſplenic veſſels in a dog of a moderate ſize, he afterwards cut out the ſpleen, but neglected to tie up the ſmall epiploic artery, which diſcharged ſo large a quantity of blood, that the dog ſeemed as if he would ſhortly expire. He nevertheleſs protruded the artery without ligature into the abdomen, where it doubtleſs continued to bleed; he then united the wound of the abdomen by ſuture, and the dog afterwards did well, the wound healing in ſix or ſeven days time. From this experiment he concludes, that blood extravaſated into the cavity of the abdomen, may be again abſorbed, without any bad conſequence following, provided the air is excluded.

4. If air enters through the wound into the cavity of the abdomen, and the orifice of the wound is in the mean time obſtructed by the fat or any other cauſe, ſo as to prevent the air from eſcaping again, it may be rarified by the heat of the body, and diſtend the abdomen to an immenſe bulk: but at the ſame time it will compreſs all the viſcera contained in the abdomen, more eſpecially the ſtomach and inteſtines, which it may preſs quite flat; whence may follow miſerable conſequences, which can only be remedied by diſcharging the rarified air.

[a] Obſervat. Anatom. Chirurg. 66.

SECT.

SECT. CCCXIV.

FROM hence these wounds are often mortal. But large wounds of the intestines which are accessible to the hand, must be conjoined by suture; or if the intestines are injured with small wounds, they may be left to themselves, and the remainder of the treatment performed as we directed at (311.)

From all that has been said it is evident, what a great diversity there is in wounds penetrating the cavity of the abdomen, and injuring the contained viscera or vessels. If now we consider what has been already said concerning the mortality of wounds in general, § 170. numb. 3, and 5, together with the wonderful disorders which have been observed to follow an injury of the diaphragm, of which we treated in the same section at numb. 4, it will easily appear that inevitable death must be frequently the consequence of wounds in the abdomen.

We come now to consider what ought to be done in the cure of wounds in the abdomen, when the intestines are injured, and are accessible to the hand. Hippocrates [a] has pronounced wounds of the small intestines to be mortal; but Galen, in his commentaries, will not have every kind of wound in the small intestines mortal, but only such as penetrate into their cavity; and these, he says, are very rarely cured. In another aphorism Hippocrates [b] says, that one of the small intestines being divided, it will not unite. Celsus likewise affirms, [c] *Si tenuius intestinum perforatum est, nihil profici posse. Latius intestinum sui potest: non quod circa fiducia sit, sed quod dubia spes certa desperatione*

[a] Aphor. 18. Sect. VI. Charter. Tom. IX. pag. 257.
[b] Ibid. 24. Sect. VI. pag. 261.
[c] Lib. VII. cap. 16.

tione ſit potior: interdum enim glutinatur: "If one of "the ſmaller inteſtines is perforated, no good can be "done. But one of the larger inteſtines may be con- "joined by ſuture: not that the cure will certainly "follow by that means, but becauſe a doubtful reme- "dy is better in a deſperate caſe than none at all; for "ſometimes it is healed."

But it appears at preſent from a great many faithful obſervations, that the ſmall inteſtines have been entirely divided, and yet the wounded patient has afterwards recovered. If therefore the inteſtines are injured with a ſmall wound, not ſufficient to let the contents into the cavity of the abdomen, they may be left to themſelves, for in that caſe the cure eaſily ſucceeds ſpontaneouſly. For ſo ſoon as the inteſtines have prolapſed through the wound, they are uſually greatly diſtended with flatus, if they are entire; and they then appear very thin and membranous: but if we conſider them in their natural ſtate, they appear ſufficiently thick and compact, ſo that a ſmall wound cannot much injure them. It is evident from the inſtance of the madman, which we mentioned in § 170. numb. 5. who inflicted eighteen wounds in his own belly; it is thence evident, that ſuch wounds of the ſmall inteſtines may heal ſpontaneouſly, as we are taught by the cicatrices of the healed wounds, which appeared in the body after death. When the ſmall inteſtines of a dog are cut open longitudinally, as we mentioned in the ſame place, upon returning them into the abdomen without any ſuture, the animal afterwards recovered. And obſervations teach us, that even pretty large wounds of the inteſtines have been cured ſpontaneouſly, though they were ſufficient to let out the contents. A man was wounded with a large bullet, which perforated the cavity of the abdomen, and entered the inteſtinum colon, with conſiderable injury, inſomuch, that for the ſpace of two months time, the fœces were diſcharged through the wound; but at length the wound healed without any aſſiſtance from

from art, and the man perfectly recovered. [d] An eminent cook was wounded in the abdomen with a knife, so that the edge penetrated the larger intestine or colon, on the right side; and though it hung out of the body for above the space of thirty hours, and was very much injured by the cold, yet it was returned again into its place without any bad consequence. The intestinal fœces were discharged daily through the mouth of the wound, and though the abandoned glutton observed no regimen of diet, yet the wound of the intestine was happily consolidated, as appeared in the dead body, six years after the wound was inflicted [e].

But when wounds inflicted on the intestines are so large, that there is reason to fear their contents will escape into the cavity of the abdomen, where, being accumulated and putrefied, they may corrupt all the adjacent parts; in this case, if the wound of the intestine is accessible to the hand, it will be proper to make the future. In these cases surgeons generally use what they call the glover's future, because the skins of animals being lacerated, are usually mended by the dresser with this kind of future. This future is performed upon the intestine by perforating both the divided lips at the same time, with a needle armed with a flat silken thread; then the second stitch is made as before, at about the distance of two lines from the first, always beginning at one and the same side of the intestine, and repeating it till the lips of the wound are contiguous; thus will the divided lips of the intestine be retained in contact, by a spiral circumvolution of the thread, a pretty long piece of which is to be left pendulous out of the wound, that the conjoined intestine may be afterwards easily extracted. On this account the stitches are to be made at larger distances, and the ends of the thread are not to be continuous with the spiral circumvolutions,

[d] Bellofte Chirurgien d'Hôpital, pag. 266. part. 3. chapit. 15.
[e] Tulpii Observat. Medicar. Lib. III. cap. 20. part 212.

which

which retain the lips of the inteſtine, as many authors direct; for then the threads cannot be drawn out of the wound without wrinkling the ſuture of the inteſtine, which will produce acute pain, inflammation, gangrene, *etc.* Upon this ſuture conſult Garengeot [f], who has given the beſt deſcription of the method of performing it.

It is very apparent, that this ſuture ought not to be performed but in caſe of urgent neceſſity, ſince it requires the inteſtine to be drawn out of the abdomen, and to be roughly handled for a conſiderable time, in the cold air; from whence fatal conſequences have been obſerved to follow by ſeveral authors. But the inſtances which we alledged in the commentary on § 170. numb. 5, where the ſtomach itſelf, divided by a wound, was conjoined by ſuture; and the inſtances which we ſhall hereafter produce in the commentary on § 317; ſufficiently prove that this operation ought not to be condemned as uſeleſs or pernicious.

SECT. CCCXV.

IF the inteſtine comes out uninjured through a large wound of the abdomen, let it be fomented by the application of live animals ſlit open, or with a proper fomentation, until it is replaced, and let the reſt of the treatment be performed as in (311.)

So long as the inteſtines remain in the abdomen, they are on all ſides moiſtened with warm vapours, and lubricated with a ſubtile oil, as we may be convinced barely from touching them in the diſſection of living animals. Therefore when the inteſtines prolapſe through a wound of the abdomen, being deprived of their moiſt and warm vapours, they ſoon

[f] Traité des Operations de Chirurgie, Tom. I. pag. 105, &c.

become

become cold, dry, and often ſpeedily tend to mortification; which we know chiefly by their change of colour. Celſus [a] has beautifully expreſſed himſelf upon this ſubject, when he ſays, *Protinus conſiderandum eſt, an integra ea ſint; deinde, an his color ſuus maneat, etc. Tum, ſi utrumlibet inteſtinum (craſſum nempe et tenue) lividum, aut pallidum, aut nigrum eſt; quibus illud quoque neceſſario accedit, ut ſenſu careat, medicina omnis inanis eſt. Si vero ea adhuc ſui coloris ſunt, cum magna feſtinatione ſuccurrendum eſt: momento enim alienantur, externo et inſueto ſpiritu circumdata:* "It muſt "be directly conſidered whether the inteſtines are "ſound, or whether they retain their colour, *etc.* "Then if either of the inteſtines, whether large, or "ſmall, appears livid, pale or black, and without "ſenſe, which is a neceſſary attendant of theſe "changes in colour, all remedies are then ineffectual. "But if the inteſtines as yet retain their colour, aſ-"ſiſtance muſt be very ſpeedily given; for they are "ſoon changed by the unuſual contact of the ambi-"ent air." And that Celſus well underſtood that the inteſtines are naturally moiſtened, not only with a thin lymph, but alſo with a fat oil, is very apparent; becauſe he ſoon after adds, [b] *Ac, ſi jam ſicciora ſunt inteſtina, perluenda aqua ſunt, cui paululum admodum olei ſit adjectum:* "But if the inteſtines appear drier "than they ought to be, they are to be fomented "with water, to which a little oil is to be added." When therefore the gyri of the inteſtines prolapſe through a large wound, they are to be immediately replaced, if they are not yet become cold or dry. The retaining of the inteſtines will be much facilitated, if the patient is placed in ſuch a poſture, that the contents of the abdomen cannot preſs upon the part wounded by their own weight; and therefore Celſus [c] would have the patient laid upon his back, with his hips raiſed. For in that poſture the viſcera,

[a] A. Corn. Celſi Medicin. Lib. VII. cap. 26. pag. 452.
[b] Ibidem. [c] Ibidem.

contained

contained in the cavity of the abdomen, preſs the diaphragm into the cavity of the thorax; by which means the capacity of the abdomen is increaſed, ſo that the prolapſed inteſtines may be more eaſily replaced. In this reduction of the inteſtines, [d] Celſus again very well adviſes, *Quod Medicus priora ſemper inteſtina, quæ poſteriora prolapſa ſunt, condere debet ſic, ut orbium ſingulorum locum ſervet. Repoſitis omnibus leniter homo concutiendus eſt, quo fit, ut per ſe ſingula inteſtina in ſuas ſedes reducantur, et in his conſidant:* "That the ſurgeon ſhould always operate ſo as to re-"turn thoſe inteſtines firſt which prolapſed laſt, that "each of their gyri may keep its place. After they "are all replaced, the perſon is to be gently ſhook, "that each of the inteſtines may reduce itſelf to its "proper place, and there remain." For unleſs this be obſerved, violent gripes and many other bad conſequences may follow.

Another admonition, of no ſmall importance, is given us by [e] Garengeot; namely, that if the wound is in the middle of the abdomen, under the navel, penetrating through the rectus muſcle, on either ſide, then the prolapſed part of the inteſtine or omentum is frequently liable to be returned under that muſcle, betwixt its body and the tendinous capſule, which very looſely encompaſſes this muſcle below the navel; ſince it might be thus falſly imagined, that the inteſtine is returned into the abdomen. It is ſufficiently evident, that the very worſt conſequences muſt follow from ſuch an error; namely, inflammation, pain, *etc.* in the inteſtine, thus violently compreſſed by the incumbent muſcle.

But when the prolapſed inteſtines are already cold, or dried by the air, it will then be beſt to foment and moiſten them before their reduction; for which purpoſe nothing better can be contrived, than the application of the inteſtines of a healthy living animal,

[d] Ibidem, pag. 453.
[e] Traité des Operations de Chirurgie, Tom. I. pag. 102.

immediately after opening its belly; for then they are warmed and moiſtened in a manner with their natural foment. Hence this method is often the only relief that can be had in the iliac paſſion, and in the reduction of incarcerated ruptures. If living animals are not at hand for this uſe, warm milk and water, with a little oil, or fat mutton broth, boiled with emollient herbs, may be uſed for the ſame purpoſe, if they are always applied of a due warmth. It is indeed true, that upon returning the prolapſed and cold inteſtines into the cavity of the abdomen, they will be there warmed and moiſtened; but we ought firſt to be certain, that life ſtill remains in the cold and ſenſeleſs parts, before they are replaced, or elſe we may expect an abſolute mortification, if they are already begun to be gangrenous; and though a ſeparation of the corrupted parts ſhould ſucceed there, the contents of the inteſtines would nevertheleſs eſcape into the cavity of the abdomen, whence the death of the patient would follow, after ſuffering the moſt miſerable diſorders.

SECT. CCCXVI.

IF the inteſtine, coming through a ſmall wound of the abdomen, cannot be reduced, either from its inflammation, diſtention with wind or fœces; let it be returned by the uſe of fomentations, by puncturing, or by dilating the wound.

When the abdomen is perforated with a large wound, the inteſtines eaſily prolapſe; but then there is alſo no great difficulty in replacing them: but when part of an inteſtine has been forced through a narrow wound, the diſorder is much more dangerous. For the prolapſed inteſtine being compreſſed by the margin of the wound, will ſoon be diſtended with flatus

flatus, or the ingefted aliments, drove thither by the periftaltic motion; whence the inteftine will be inflamed, tumified, and incapable of being returned through the ftricture of the wound; whence a ftoppage of the circulation and a gangrene foon follow, as hath frequently been obferved in incarcerated ruptures. It is very evident, that in this cafe the inteftine cannot be reduced, unlefs the diftention of it be firft diminifhed, or the wound dilated; the former of which ought always to be firft attempted, fince the dilatation of the wound cannot be performed without pain and danger. Thofe fomentations may be therefore applied warm, which are directed under the preceding aphorifm; and then it may be gently attempted by the hand, to propel the flatus or other contents through the wound, into the common tract of the inteftine, by which means the tumor may fubfide, and the inteftine may be reduced. But if it fhould continue diftended with flatus, and fomentations have been ufed for fome hours without effect, the diftended part of the inteftine may be then punctured with a needle in feveral places, to difcharge the flatus. Nor is there any danger to be feared from thefe fmall wounds; for the flatus being difcharged, the inteftine will contract, and the fmall openings made by puncture will difappear; nor will they permit any of the inteftinal contents to efcape. [a] Parey tells us, that he has fucceefsfully ufed this puncturation of the inteftine. But to prevent the ignorant from blaming or reflecting upon this method of perforating the inteftine, it is beft to perform it privately, as it may be done without difficulty. For the fatal event of fuch a wound might be fometimes afcribed to the furgeon, though he does no more in the cafe than what art evidently requires.

But if neither this method fucceeds, a dilatation of the wound then only remains; which Celfus [b] has alfo

[a] Livre X. Chapitre 36. pag. 256.
[b] A. Corn. Celf. Medic. Lib. VII. cap. 16.

recom-

recommended in this case, when he says, *Si angustius vulnus est, quam ut intestina commode refundantur, incidendum est, donec satis pateat:* "If the wound is narrower than will conveniently permit for returning "the intestines, it must be sufficiently enlarged by "incision." But great caution is here evidently required, because the prolapsed intestine, being very strictly compressed by the wounded lips of the peritonæum and integuments, may therefore be easily injured. To avoid this, the surgeon introduces a grooved probe or director into the cavity of the abdomen, drawing the intestine a little back at the same time, when that is found necessary; and then, that he may be certain the intestine is not intercepted, betwixt the director and the margin of the wound, he draws the intestine a little more out; he then introduces his incision knife into the groove of the director, and carefully divides the peritonæum: this done, he then elavates the director and incision knife lodged in its sulcus, and divides the integuments of the abdomen, till the wound appears sufficiently large, for the commodious returning the intestine into the cavity of the abdomen. But if the stricture upon the prolapsed intestine is so great, that it is impossible to introduce the director, then the intestine is to be pressed with the fleshy part of the fore-finger, that it may recede a little from the margin of the wound; and then let the integuments and peritonæum be divided a little, upon the nail of the same finger, to make way for the introduction of the grooved probe or director.

To perform this operation with the greatest safety, several useful instruments have been contrived by celebrated surgeons. Thus we are furnished with a director, which conceals an incision knife in its groove, that can be raised at the pleasure of the surgeon, by pressing upon a spring; the figure of which instrument may be seen in Heister's surgery [c]. Petit used

[c] Institut. Chirurg. part. II. cap. 114. tab. 24. pag. 797.

only a ſtreight inciſion knife, furniſhed with an obtuſe point, and with a very dull edge: this knife he introduced perpendicularly into the abdomen, without danger of injuring the viſcera; becauſe it had a globular point, and would not eaſily cut; yet the edge of the knife was ſharp enough to divide the very tenſe integuments of the abdomen [d]. The ſimplicity of this method has pleaſed many, but there are other ſurgeons who prefer the former inſtrument.

The wound being thus dilated, and the prolapſed inteſtine returned, all the reſt is to be conducted in the manner deſcribed at § 311.

SECT. CCCXVII.

IF part of the inteſtinal tube is loſt either by a wound, ſuppuration, or gangrene, and the upper part of the inteſtine offers itſelf, or can be carefully drawn out, it ought then to be ſewed to the margin of the wound.

But if the inteſtine is entirely divided; or if prolapſing through a narrow wound, and not being returned in time, part of it ſhould be deſtroyed by a ſuppuration or gangrene; in that caſe the continuity of the inteſtinal tube is removed; and if the divided ends are returned into the cavity of the abdomen, it is very evident that the chyle of the inteſtines, being diſcharged into that cavity, accumulated and there putrefied, muſt produce a train of miſerable conſequences, and inevitable death itſelf. The ſame is alſo true, if the inteſtine be returned entire, but invaded in ſome part with a gangrene; for the diſeaſed part muſt then ſeparate, whence all the ſame maladies will follow. All that art can then perform, is, to attach the end of the divided inteſtine to the ex-

[d] Garengeot Traité des Operations de Chirurgie, Tom. I. pag. 519.

ternal

ternal margin of the wound; and thus a filthy drain will be there fixt during life, which will supply the place of the anus. Physicians and surgeons formerly had no hopes of this concretion of the divided intestine; being opposed by the authority of Hippocrates [a], who says, *Si intestinum tenue dissecetur, non concrescit:* "That if a small intestine be divided, it "does not heal or unite." But we are taught by wonderful observations, that such a concretion is not always to be despaired of. A strong man had been afflicted with a rupture the space of eight years, which however did not give him much trouble; but on a sudden the hernia swelled with a considerable hardness, which the surgeons in vain attempted to remove, by the application of emollient cataplasms. At length the tumour suppurated, and being opened, the surgeon amputated part of the intestine, which was putrefied to the length of four fingers breadth; afterwards a portion of the same length separated spontaneously. When it was now believed by every body, that an opening would remain in this place, which would perform the office of an anus during the patient's life; yet beyond all expectation the discharge of humours from the wound grew less, and the patient was cured within the space of thirty-three days, and lived afterwards perfectly in health [b]. We are still more evidently taught by another case, that an intestine which has been totally divided may unite together. In a man afflicted with a rupture, part of the intestinal tube, to the length of six inches, was destroyed by a gangrene. A thread being passed through that part of the mesentery to which the corrupted intestine adhered, both ends of the intestine were by that means retained in the mouth of the wound, with a view that they might adhere to the margin of the wound, and that the upper end of the

[a] Aphorism. 24. Sect. VI. Charter. Tom. IX. pag. 261. & in Coacis Prænot. numb. 503.

[b] Academie des Sciences l'an 1723. hist. pag 41, &c.

inteſtine might perform the office of an anus, the other end remaining uſeleſs: but in a month's time the two ends ſo united, beyond all expectation, that the ingeſted aliments were diſcharged again, by their common courſe, through the anus; ſo that the man recovered, only with this inconvenience, that if he eat much, he was troubled with the colic, which began at the part wounded, and grew leſs upwards. This ſeems to have been the conſequence of a ſtricture in the inteſtinal tube, which was not only narrower, but of a more compact ſubſtance, and leſs able to yield, where the two ends were united [c]. This is alſo confirmed by another remarkable inſtance. Ramdohrius, ſurgeon to his Serene Highneſs the Duke of Brunſwick, removed a conſiderable part of the corrupted inteſtine, in a woman who had an incarcerated rupture, which broke ſpontaneouſly; he afterwards introduced the upper end of the inteſtine into the lower, and having conjoined them by a ſlight ſuture, replaced them into the abdomem. This woman being thus ſnatched from the jaws of death, lived afterwards in health; but being taken with a pleuriſy, ſhe expired in about a year from that time, and upon opening her body, the ends of the inteſtine appeared to have well united together. This inteſtine, together with part of the abdomen to which it adhered, is now kept by the celebrated Heiſter [d], to whom it was given as a preſent by an expert ſurgeon.

But it is very evident, that ſuch an union of the divided inteſtine will not follow, if the two ends are left fluctuating in the abdomen; but for this purpoſe it is required that they remain in contact with each other, by adhering to ſome adjacent part; and therefore this union more frequently happens in ruptures, becauſe the extremities of the inteſtine, coming thro' the ring of the abdominal muſcles, folded together,

[c] Ibidem, pag. 44.
[d] Inſtitut. Chirurg. part. II. cap. 117. pag. 818.

remain

remain in contact with each other, as it is beautifully demonstrated and illustrated with figures by the celebrated Morand [c], who has very reasonably deduced the manner of concretion, and the other consequences thence arising from the structure of the parts. It is in the same place proved, that the capacity of the intestinal tube is always less in the part where it is joined, which the same author testifies he has frequently seen after death in the bodies of those, who have been afflicted with these disorders. On this account therefore, if the patient does not abstain from the more compact food, and eat in small quantities at a time, there will be danger of an obstruction at the stricture, whence follow the most acute pains, and often a rupture of the part tho' long conjoined; of which we have an instance in a woman, who expired from this cause many years after she had been perfectly cured, in whose abdomen both the ingested aliments and medicines were found discharged by a rupture of the intestine in that part, where its two divided ends had united [f].

But when there are no hopes that the divided ends of the intestinal tube can be united with each other, the only method that then remains is to conjoin the upper end of the intestine by suture to the margin of the external wound; where it sometimes naturally tends, or is cautiously conducted by art, to serve as an artificial anus during life; while the other end, being tied with a ligature to prevent its present contents from escaping into the abdomen, remains ever afterwards useless. And in this manner may life be preserved, if the length of the intestinal tube from the pylorus to the artificial anus be sufficient to absorb chyle enough from the ingested aliments to supply the blood, for repairing those losses which are made in the substance of the body by the continual actions of life. But in order to know which of the two extremities

[c] Acad. des Sciences l'an. 1735. Mem. pag. 335, &c.
[d] Ibid. pag. 376.

belongs to the upper tract of the inteſtines continued to the pylorus, take the ſigns delivered by the celebrated Littre [g]: for the upper extremity will have an apparent vermicular motion, the matter of the chyle will paſs alternately through that extremity, the ſides of which will not appear entirely collapſed, or if they do ſometimes collapſe, they will be ſoon after elevated by the matter contained in the cavity of the inteſtine protruded there. But in the other end of the divided inteſtine, which is continued to the rectum, there will be no periſtaltic motion, nor any thing diſcharged from thence, unleſs in the beginning, or when ſomething is forced out by a convulſive and retrogade motion aſcending from below upwards; and which never follows ſo regularly, as it may be diſcerned in the upper extremity. That extremity being found which is continued to the duodenum, the ſurgeon then divides its circumference in three places, and unites it by ſuture to the margin of the wound; or elſe by paſſing threads through the end of the inteſtine, retains it in the mouth of the wound, till it there conjoins. Thus may life be preſerved by art, but not without a very foul inconvenience, ſince the fœces muſt paſs this way ſo long as the perſon lives. It ſometimes happens, that the upper extremity of the divided inteſtine conjoins with the mouth of the wound by the aſſiſtance of nature only. Thus M. Mery [h] cut off above five feet in length of a mortified inteſtine in a maid of twenty-eight years old, following an incarcerated rupture; and the upper orifice of the inteſtine adhered afterwards to the inguen, where the fœces were diſcharged during the remainder of life; and they were ſufficiently hard and figured, when ſhe took food of eaſy digeſtion and in moderate quantities. Many ſuch caſes have happened after a battle, when ſoldiers ruſh upon the enemy with their bayonets fixt upon their muſkets, whence frequently

[g] Acad. des Sciences l'an 1700. Mem. pag. 394.
[h] Ibid. l'an 1701. pag. 372, 373.

follow

follow very bad wounds of the abdomen, attended with a diviſion of the inteſtines. I remember to have ſeen a ſoldier about twenty years ago, in whom the inteſtinum colon adhered to the external orifice of the wound after it had been divided in this manner; and as he begged alms, he readily permitted the inteſtine to be examined, which adhered with ſome part of it hanging out, ſo that one might very well examine the ſurface of the inteſtine. It was then ten years ſince he received the wound, and he ſeemed to enjoy a perfect ſtate of health.

SECT. CCCXVIII.

IF the omentum is prolapſed and appears as yet moiſt, warm, and reddiſh with the circulating blood, it is to be replaced as before (316).

Hippocrates ſays [h], *ſi omentum excidat, neceſſe eſt putreſcere*; "That if the omentum prolapſes through "a wound, it muſt neceſſarily corrupt or mortify." Certain it is, that the tender fabrick of the omentum cannot be long expoſed to the cold of the external air, without a conſiderable injury of the vital circulation of its juices, which is ſometimes totally deſtroyed by the ſame means; and therefore it ought to be replaced immediately if it is poſſible. But it muſt be obſerved, that the membrane of the omentum is ſo thin, that it will not bear to be roughly handled without laceration; and therefore the greateſt circumſpection muſt be uſed in replacing it; for otherwiſe, by breaking the ſmall veſſels of the omentum in a rough reduction of it, the conſequences may be inflammation, ſuppuration, a gangrene, and a train of the worſt maladies. For this reaſon therefore the wound ought rather to be dilated, that the omentum may be replaced without violence. The moiſture,

[h] Aphoriſm. 58. Sect. VI. Charter. Tom. IX. pag. 289.

warmth, and red blood, visible in the small vessels of the omentum, denote that the vital motion of the juices still continues in the part which is prolapsed through the wound.

SECT. CCCXIX.

BUT if the omentum appears dry, cold, or livid, it is to be first treated with fomentations, or else removed by incision before it is replaced.

But when the omentum has lain a considerable time out of the wound, it usually mortifies, and that in a very short time; which may be known from its coldness, dryness, and livid or black colour. It would be dangerous to return a part thus mortified into the abdomen; for by its separating afterwards from the living parts, it would putrefy in that cavity, and infect all the adjacent viscera: upon which account Celsus [a] advises to consider the state of the omentum after the intestines have been returned into the abdomen: *Ex quo, si quid jam nigri & emortui est, forfice excidi debet; si quid integrum est, leniter super intestina reduci*; "That if any part of it is already black or "mortified, it must be cut off with a pair of scissors; "and if any remains found it may be gently returned "over the intestines." But if notwithstanding the change of colour, there remain some hopes that the life of the part may be recovered, let it be treated with emollient fomentations, and especially by the application of live animals slit open; and when the signs of life appear again, to wit, moisture, warmth, and redness of colour, it is then to be returned into the cavity of the abdomen, or else what is mortified must be cut off. There are however some celebrated surgeons, who return the omentum if it only appears li-

[a] Lib. VII. cap. 16. pag. 453.

vid

vid in a small degree; and they affirm, that no bad consequences have followed from thence [b]: for then life easily returns into this part by the natural heat of the body. But when the mortified part of the omentum is to be extirpated, a thread is first passed round the sound part, and then tied, for cutting off what is mortified under the ligature, at about the distance of a finger's breadth from it; the remainder is then returned into the abdomen, taking care that a sufficient length of the thread may hang out of the wound, that it may be conveniently extracted after the separation is made. Nor has there any great inconvenience been observed to follow after a part of the omentum has been thus extirpated. Galen [c] indeed tells us, that a part of the omentum being lost, renders the stomach colder and less apt to make a good digestion; and affirms, that he has seen a certain gladiator, who had lost almost the whole omentum by a wound, and he was afterwards obliged continually to wrap up his abdomen with flannels to avoid injury from the external cold. But it is evident from numberless observations since made, that this accident has not followed a loss of the omentum [d]; upon which account it would seem, that it may be safely extirpated, which is also confirmed, because we frequently observe a great part of the omentum wanting in dead bodies, notwithstanding the functions of the abdominal viscera have been duly performed in those persons.

SECT. CCCXX.

PLentiful bleeding, with the injection of clysters in the beginning when the large intestines are uninjured, a proper regimen of diet, a

[b] Dionis Cours d'Operations de Chirurgie demonstrat. 2. pag. 73. Garengeot Traité des Operations de Chirurgie, Tom. I. pag. 120.
[c] De usu part. Lib. IV. cap. 9. Charter. Tom. IV. pag. 377.
[d] Acad. des Sciences l'an 1725. hist. pag. 13.

quiet

quiet reſpiration with reſt, and a proper poſture of the body, are here the principal remedies.

From what has been hitherto related, ſeveral general methods of relief are deduced, which have been always found highly ſerviceable in the moſt dangerous wounds of the abdomen; theſe are,

Bleeding.] Nothing is here more to be feared than an inflammation of the abdominal viſcera, which ſpeedily tending to a gangrene, after the moſt excruciating pains, often kills the patient in a very little time; but herein we have the moſt relief from plentiful bleeding, which uſually removes the preſent inflammation, and prevents the future. Thus in the incarcerated rupture ſcarce any remedy ſucceeds, unleſs the ſtrength be weakened by a very bold repetition of phlebotomy, ſo as to reſtrain the too great impetuoſity and inflammatory motion of the vital powers.

Clyſters, *&c.*] If the large inteſtines are injured, it is very evident, that clyſters will be pernicious by eſcaping into the cavity of the abdomen; but if they appear to be entire, then clyſters will be extremely ſerviceable, by diſcharging the hard fœces of the large inteſtines; that the patient may not be afterwards obliged to ſtrain violently upon the ſtool for their expulſion. For in evacuating the bowels, the diaphragm is preſſed downward by the inſpired and retained air, and the abdominal muſcles acting at the ſame time, very ſtrongly, compreſs all the parts contained in the abdomen, which will therefore preſs upon the part wounded, ſo as to force out either the omentum or inteſtines, or elſe lacerate or break open again that which lately began to heal: whence the uſefulneſs of clyſters in wounds in the abdomen is ſufficiently evident.

Diet.] It was ſaid before, under the cure of wounds in general, in § 192. that thoſe aliments are chiefly ſerviceable to thoſe who are wounded, which are of a mild nature and eaſily digeſted or aſſimilated, with-

out being apt to putrefy, provided they are taken often and in ſmall quantities at a time. But in wounds of the abdomen it muſt be alſo conſidered, that the action of thoſe viſcera is often injured, which ought to have the greateſt ſhare in changing the crude aliments ſo effectually, that they may be afterwards capable of forming part of ourſelves by the action of the lungs and veſſels; at the ſame time alſo it muſt be obſerved, that a large quantity of aliments taken at once will immediately diſtend the ſtomach and inteſtines; whence it is evident, that great caution is required in managing the diet. But it will be alſo of the greateſt uſe here to give ſuch aliment as leaves the leaſt quantity of groſs fœces in the inteſtines; ſince ſtraining upon the ſtool, after all the fœces have been firſt diſcharged by a clyſter, ought to be avoided as much as poſſible. All theſe intentions are anſwered by nothing better than the uſe of broths of the fleſh of young animals; for if three or four ounces of them be taken every two hours, mixed with a little citron juice to prevent them from degenerating too eaſily into a putrid ſtate, life will then be ſupported with little or no action of the ſtomach and inteſtines to change theſe aliments; and at the ſame time very few or no fœces will be collected in the inteſtines, ſo that the patient may remain without going to ſtool for ſeveral days or even weeks without detriment. Toaſted bread may be ſoaked or boiled in theſe broths, provided it be afterwards taken out to avoid increaſing the quantity of fœces in the large inteſtines: and as for drink, mere water, with the addition of a little wine, will be ſufficient; but a decoction of bread, barley, or oats, or even ſoft ale, may be ſometimes allowed. Milk, if not its whey, is to be here avoided; becauſe it leaves too large a quantity of groſs fœces, as we ſee evidently in infants, who frequently diſcharge very thick and groſs fœces, though they only ſuck the milk of their mother.

Quiet

Quiet reſpiration, reſt, and poſture of the body.] For at every inſpiration the abdominal muſcles are diſtended, and contracted again at the time of expiration, by which means the contents of the abdomen will be alternately compreſſed; therefore the quieter the reſpiration, the leſs will the wounded parts be agitated, and the more eaſily united. For the ſame reaſon too reſt is here very neceſſary; but the poſture ought to be that in which the patient may remain with the moſt eaſe, namely, with the body placed a little erect upon a couch, or ſitting nearly in the ſame poſture, with the orifice of the wound inclined as much as conveniency will permit, that the blood, matter, and other humours may have a ready diſcharge, without being collected in the cavity of the abdomen.

Theſe are the means proper to be uſed in all wounds of the abdomen, as alſo after cutting for the ſtone, or a fiſtula of the anus; for unleſs the patient be not obliged to ſtrain upon the ſtool in thoſe diſorders, the very worſt conſequences may follow, though the operation has been happily performed. It is alſo evident from obſervations, that the moſt deſperate wounds of the abdomen, attended with the worſt ſymptoms, have been happily cured by this method. It will be ſufficient for us at preſent to produce only one inſtance, which we have already mentioned once before upon another occaſion in the commentary on § 170. numb. 5. A mad-man inflicted eighteen wounds in his abdomen, eight of which penetrated its cavity and injured the contained viſcera. The violent fever, tenſion of the abdomen, difficult and painful reſpiration, nauſea, vomiting, diarrhœa, *&c.* afforded a ſevere prognoſis, inſomuch that he was almoſt given over. Phlebotomy was repeated ſeven times in the four firſt days, the diet was very thin, compoſed almoſt entirely of fleſh broths, with the addition of lettuce, ſuccory, purſlain, and the like mild pot-herbs; perfect reſt was procured

procured with lenient and diacodiate emulsions; and by a careful and seldom dressing of the wounds with those means, the patient not only recovered from so many wounds, but became perfectly well both in body and mind. Seventeen months after this he became mad again, and threw himself from a high precipice, by which he was instantly killed; and on opening the body, the cicatrices which appeared demonstrated, that the middle lobe of the liver had been wounded, as also had been the intestinum jejunum and the colon [a]. This history demonstrates how much we may expect from this method in the most dangerous cases.

Of Contusions.

SECT. CCCXXI.

IF a hard and obtuse body does by its motion, resistance, biting, or pressure, break or lacerate many small vessels at the same time, that injury is termed a contusion.

A contusion is a solution of continuity made in any part of the body by a hard instrument, whose surface does not terminate either in a point or edge, but in some obtuse figure; for by this it is distinguished from a wound, which is a solution of continuity made by a wounding or sharp instrument. Hence a contusion is always *(cæteris paribus)* larger, or occupies a greater space than a wound, because the contusing instrument is applied to a larger surface of the body. It now therefore is very evident, that the effect will be the same, whether the obtuse body in motion strike upon a part of the human body, or whether a part of the human body in motion be forced against a hard obtuse and quiescent obstacle, or

[a] Acad. des Sciences l'an 1705. Mem. pag. 40, &c.

whether

whether the obtuſe body preſſes upon the part by its own weight, or by pinching cruſhes any part.

SECT. CCCXXII.

THE idea of which is an aſſemblage of little wounds with a cruſhing of the ſolid fibres and veſſels.

There may be ſo many ſmall wounds conceived in the contuſion as there are injured parts within its circumference, ſo that an aſſemblage of ſmall wounds cloſe to each other gives the whole idea of a contuſion: thus for example, if an artery be divided by a razor, it is a wound; but if it is divided by an infinite number of inciſions very cloſe to each other, it will in a manner repreſent a contuſion of ſuch an artery. But the more ſolid, hard, and reſiſting parts are uſually broke or ground into very ſmall fragments; as for example, when the bones of the arm are by any cauſe broke in two, it is termed a fracture; but if they are cruſhed into ſmall fragments, it is denominated a contuſion.

SECT. CCCXXIII.

THE effects are therefore a ſolution of continuity with laceration, a deſtructive cruſhing of many fibres and veſſels at the ſame time, an extravaſation of the juices into the adjacent vacuities, which are either there naturally ſeated, or made by the accident, with an infinite number of maladies which may follow from thence. A mortal emphyſema, following a fracture and contuſion of the ribs, may be ſeen in Mem. Acad. l'an 1713. pag. 119.

A ſolu-

A ſolution of continuity with laceration.] A laceration is when the ſoft parts of the body are ruptured by diſtracting, and this diſtraction being preſent in all contuſions diſtinguiſhes them from wounds, in which there is alſo a ſolution of the continuity, but without that laceration, ſince a wound is inflicted by a ſharp inſtrument. A wound may indeed be joined with contuſion, but then it is a compound diſorder.

A deſtructive cruſhing, *&c.*] A wound being attended with a ſimple diviſion only of the parts, which before cohered, gives an opportunity frequently for a happy cure, even in the largeſt wounds, by a concretion of the divided parts brought again into contact. But in a contuſion the parts are ſo ground to pieces, that their vital fabrick being deſtroyed, it is impoſſible for them to unite again with the parts adjacent; and this makes a ſeparation of them all neceſſary in order to a cure; becauſe being deprived of all the vital influx of their juices, they are now dead, and are to be conſidered as foreign bodies interpoſed betwixt the living parts, which are thereby prevented from uniting with each other. Hence Hippocrates[a] juſtly pronounces, *Carnes contuſas neceſſario in pus verſas tabeſcere*; "That contuſed fleſh "being converted into matter, muſt neceſſarily be "deſtroyed or waſted." Therefore he would have a ſuppuration to be ſpeedily procured in this caſe.

An extravaſation of the juices into the adjacent vacuities, *&c.*] The veſſels being ruptured, their contained juices are then extravaſated and depoſited in foreign parts. Even Hippocrates[b] has been bold enough to pronounce, that the whole body is full of cavities, *Omne enim non concretum, ſive cute, ſive carne tegatur, cavum eſt. Impletur autem ſanum quidem ſpiritu, ægrotum vero ichore*; "For all that is not con-"creted or ſolid is hollow, whether it be covered "with fleſh or ſkin. The cavity is indeed filled with

[a] De ulceribus, cap. 2. Charter. Tom. XII. pag. 131.
[b] De arte, cap. 8. Charter. Tom. II. pag. 150.

"air

" air in a healthy ſtate, but in a diſeaſed ſtate with " ichor." Therefore the extravaſated humours will every where find a paſſage into theſe ſmaller or larger cavities of the body. For there is ſcarce any veſſel, muſcle, tendon, or even fibre in the whole body, but what is inveſted with a membrane very eaſily dilatable, and compoſed of many cells communicating with each other: the ſmall cells or cavities therefore of this membrane are diſperſed through every part of the body, and may be filled with the juices extravaſated from the ruptured veſſels. But for the larger cavities of the body, ſuch as the ventricles of the brain, the cavity of the thorax, of the veſicles, trachea, and bronchia of the lungs, with the cavity of the pericardium, abdomen, ſtomach, *&c.* theſe are ſufficiently known. But the extravaſated humours may not only fill theſe larger or ſmaller cavities, which are naturally in the body, but they may be alſo there accumulated, and by diſtending or removing the parts which were before contiguous, they may either make new cavities, or elſe greatly increaſe the magnitude of the natural cavities; as for example, after a violent contuſion of the head, the veſſels of the dura mater being ruptured, the blood extravaſated and collected betwixt that membrane and the ſkull, may ſeparate the dura mater from the cranium, to which it before ſtrictly adhered; and thus will a new cavity be formed, which was not there before.

With an infinite number of maladies, *&c.*] All the maladies which follow from contuſion are reducible to three heads; for they either ariſe from a rupture of the ſolids, and an extravaſation of the fluids, which deſtroy the functions reſulting from the determinate motion of the juices through the entire veſſels; or elſe they follow from the preſſure of the extravaſated humours, collected in ſome natural or preternatural cavity of the body, and by their weight or bulk diſturbing or aboliſhing the functions of the adjacent

jacent parts; or lastly, they follow from the putrefaction of the stagnating and extravasated juices, which may acquire an acrimony sufficient to corrode and destroy the circumjacent parts. If now these three circumstances are applied to every particular part of the body, it is evident, that an infinite number of maladies may thence follow, which it would be impossible to enumerate, and therefore it is sufficient for me to have pointed out their general sources. The instance which is here referred to in the Mem. R. Acad. S. teaches us, that violent contusions may be frequently attended with surprising symptoms, not easy to be foreseen by the most skilful in the profession. A man of sixty years of age had his ribs fractured and contused by the wheels of a chariot running over his breast, so that a fragment of a rib slightly wounded the external membrane of the lungs, whence part of the inspired air escaping by the wound into the cavity of the thorax, insinuated itself into the cellular membrane, and inflated almost the whole surface of the body with a surprising emphysema, insomuch that the miserable patient was suffocated on the fourth day after the accident. [c] Parey has formerly observed such a flatulent tumour formed about the ribs after contusions; but he does not seem to have well understood the cause. There are many other instances to be met with in the writers of observations, which teach, that a violent contusion has frequently wounded or separated the liver, spleen, *etc.* without any apparent injury in the external parts, whence sudden death. Even sometimes a violent contusion has been observed to produce sudden death, though no considerable injury could be observed either in the external or internal parts. See what has been said upon this subject, in the commentary on § 274. A remarkable case of this nature is related in Bohnius [d], of a man who was struck by a stone of several

[c] Liv. XII. chap. 6. pag. 293.
[d] De renunciatione vulnerum, pag. 17.

pounds weight, which was violently flung againſt the right hypogaſtrium, whereupon he ſuddenly fell down and expired. When Bohnius examined the dead body by order of the magiſtrate, he found no injury either in the integuments, viſcera, or veſſels, only the diaphragm was a little contuſed and livid, in that part of the ſame ſide where it is contiguous to the falſe ribs, but the whole compaſs of the bruiſe was ſcarce equal to half a crown.

SECT. CCCXXIV.

BUT the worſt of theſe caſes (323) is, when the internal parts are ſo injured (321, 322, 323), the integuments remaining entire, that the juices ſtagnate, congeal or putrefy; whence an ecchymoſis, a ſpurious aneuriſm, a black or blue ſpot, an ulcer, gangrene, or mortification; and in the glands, a ſcirrhus or cancer.

The ſkin being tough and very coheſive, is not ſo eaſily ruptured by an obtuſe inſtrument; but the veſſels running through the panniculus adipoſus, placed under the ſkin, are much more tender and more eaſily broken. Thus if any one ſhould receive a blow with a hammer upon the finger, the ſkin will generally remain whole, but yet a black ſpot will deform the contuſed part by an extravaſation of the blood from the ruptured veſſels under the entire ſkin; and this more eſpecially happens if the ſubcutaneous veſſels are forced by the contuſing body againſt any ſubjacent hard bone; for which reaſon it is, that ſuch large tumours ſo ſuddenly ariſe, when the head is ſtruck againſt ſome hard obſtacle. But the juices thus extravaſated from the ruptured veſſels, and confined by the entire ſkin, are collected in the cellular membrane, where they ſtagnate, and therefore congeal; and where they may at length putrefy, though but ſlowly,

ſlowly, if no acceſs be given to the external air. Various bad conſequences may from hence ariſe, the principal of which may be referred to thoſe that follow.

Ecchymoſis.] This is an extravaſation of the juices from their veſſels under the integuments, a definition of which is given us by Ægineta [a]: *Carne contuſa a quodam gravi illapſo, et parvis in illa venulis divulſis ſanguis profunditur per diapædeſin: qui, ubi colligitur ſub cute, facit illud, quod vocatur ecchymoma. Non divulſa cute ſic ut tumor mollis tactui cedens ſequatur, lividus et indolens at plurimum:* "The fleſh being contuſed by "the ſtroke of ſome heavy body, and the ſmall veſ-"ſels therein ruptured, their blood is then extrava-"ſated *per diapædeſin*, and being collected under the "ſkin, forms what is called an ecchymoſis. Thus "the ſkin not being divided, a ſoft tumour is form-"ed, which yields to the touch, and is generally li-"vid, and without pain." And thus Galen [b] ſays, that an ecchymoſis is when the blood is extravaſated from the veſſels into the circumjacent ſpaces; and in another place [c], that when the contuſed fleſh extravaſates its blood in a part under the ſkin, the diſorder is termed (ἐκχύμωμα) a ſuffuſion.

A ſpurious aneuriſm.] That is, when a large artery being injured, diſcharges a conſiderable quantity of blood into the panniculus adipoſus, where it is collected under the ſkin; concerning which, ſee the commentary on § 178. So that a rupture of the ſmaller veſſels, extravaſating but a ſmall quantity of blood under the ſkin which remains entire, the diſorder is then termed an ecchymoſis; but when the ſkin is diſtended with extravaſated blood, from the rupture of a conſiderable veſſel, it is termed a ſpurious aneuriſm.

[a] Lib. VI. cap. 30. pag. 66. verſa.

[b] In Commentar. in Aphor. 20. Sect. VI. Charter. Tom. IX. pag. 259.

[c] Commentar. 3. in librum Hippocrat. de Medici officina, text. 31. Charter. Tom. XII. pag. 98.

A black or livid ſpot.] When the preſſure of the atmoſphere on the ſurface of the body is either diminiſhed, or wholly removed from any part, either by ſucking, the application of cupping-glaſſes, or the like; the blood then ruſhes into the veſſels of the part leſs preſſed, and diſtends them, ſo as to enter many of the ſmaller dilated veſſels, which did not naturally contain any red blood, and the red parts being impacted in theſe veſſels without being able to return, give the appearance of a red, livid, or often of a blackiſh ſpot. Such a ſpot being formed in any part by ſuction, the part is ſaid to be blood-ſhotten; but when a part, being ſtruck with a hammer, has its blood-veſſels ſuddenly compreſſed by the ſtroke, then alſo the blood may be forced into the lymphatic or ſerous veſſels, and by changing their colour, may produce a very conſiderable ſpot of this kind. Blood-ſhot therefore differs from an ecchymoſis, in as much as the blood is ſtrongly preſſed into the ſerous veſſels without any rupture in the former; but in an ecchymoſis, the veſſels being ruptured, the blood is extravaſated into the adjacent ſpaces; whence the former of theſe takes place, rather about the circumference, than in the middle of the contuſed part. But it is very evident, that both blood-ſhotten and ecchymoſis may both of them follow after violent contuſions, whence they are frequently confounded by authors without diſtinction.

Ulcer and gangrene.] That is when the extravaſated humours corrupt by ſtagnating, and inflame or erode the adjacent parts. Even ſometimes the circulation is ſtopt, by too great a diſtention of the cellular membrane with the extravaſated juices, whence a gangrene and mortification may follow.

Caries.] That is, when the forementioned injuries extend to the ſubſtance of a bone.

In the glands a ſcirrhus or cancer.] Since it is evident from anatomy, that the glands are compoſed of innumerable ſmall arteries, by the different diſpo-

ſition

sition of which a thin juice is separated from the arterial blood, and being collected, is afterwards discharged by an excretory duct; it is therefore evident, that a contusion of the glands may so injure their small vessels, and compress or obstruct their emissaries, as to deny a free passage to the humours separated by the arterial fabrick; whence a stagnation, and the more fluid parts of the juices being either exhaled or else absorbed by the small veins, an inspissation of the secreted juices follow, and forms a hard, indolent, and almost irresolvable tumour, which we call a scirrhus; which scirrhus becoming inveterate, extremely hard, knotty, and accompanied with pain, is then termed a cancer.

SECT. CCCXXV.

A Contusion also frequently injures the bones, and then follow all the symptoms before described (249, 250, 251, 254, 256, 257), with an injury of the medulla; whence ulcers, fistulæ, caries, and putrefactions within the bones; for the medulla in the bones, will be thence affected like the brain in the skull, as at (273, 274).

When a contusion has extended itself into a bone it may compress or rupture the vessels which run betwixt the component lamellæ of its substance; whence the vital circulation of the juices in the lamellæ is destroyed, and they therefore mortifying, must be exfoliated, or cast off from the subjacent living parts of the bone. But this disorder may by degrees spread itself through the whole substance of the bone, in the manner explained before under the aphorisms here cited, treating of the several injuries of the bones of the skull.

An injury of the medulla, &c.] This is an accident the most of all to be feared in contusions of the bones; for the marrow is lodged within the cavities of the larger bones, and there is a like substance interspersed betwixt the cells or spungy parts of the bones. But as the brain is defended with a bony covering, so the medulla lies secured within the cavity of the bone; and as the brain is covered with a peculiar membrane, called the pia mater, which receives and distributes the vessels entering its substance; in the same manner also is the medulla invested with a fine vascular membrane, for the same uses. The arteries of the pia mater, having deposited their thicker coats, appear very thin; and the same is also true, in the arteries which are extended to the substance of the medulla: so that the marrow taken out of the thigh bone of an old ox, may be easily pressed into a mere oil betwixt the fingers, notwithstanding it appears to be furnished with innumerable arteries. Also as a fissure, fracture, or contusion of the skull, may communicate its disorders by the corrupted or extravasated humours, so as to infect the brain itself; so likewise an injury in a bone may be extended to its medulla. A violent concussion of the head may rupture many of the small vessels of the encephalon, while the skull remains entire; and it is very evident, that the same may also happen to the medulla, if a bone which contains marrow is violently struck by a blow. Now when the tender vessels of the medulla receive the disorder from the investing bone, or are injured by any other cause, the medullary oil, extravasated from the ruptured vessels, stagnates, and thereby acquires a most malignant and rancid acrimony, so as to erode all that it touches, and render the bone itself carious; whence follow most malignant and almost incurable ulcers, with obstinate fistulæ, not to be cured, unless the parts can be cleansed from the corrupted medulla. From this malignant erosion, by the putrid oil, follow a destruction

tion of the parts, with an infinite number of other diſorders, of which we ſhall treat hereafter, in the diſeaſes of the bones, at § 526.

SECT. CCCXXVI.

AND ſometimes the muſcles are alſo injured in like manner by contuſions, whence large abſceſſes or ſuppurations, gangrene, palſies, or a ſtiffneſs or contraction: but if the contuſion deſtroys large nerves which diſtribute many branches, it then certainly produces a palſy, a withering, inſenſibility, or a gangrene of the parts below, not to be cured by any art; but this is more eſpecially true of the *ſpina dorſi*, and its contained medulla.

Muſcles.] It appears from the modern anatomy, that any viſible muſcle may be divided into ſmaller bundles of muſcular fibres; nor have we hitherto been able to find out the extent of this diviſion, even though aſſiſted by microſcopes: for no one has been ever yet able to ſee a ſingle muſcular fibre, but always ſeveral fibres appear collected together. Theſe faſciculi of muſcular fibres are inveſted with a thin cellular membrane, which contains a ſubtile oil for lubricating thoſe fibres. But the ſmall arteries are very numerouſly diſperſed betwixt the interſtices of thoſe faſciculi, within the cellular membrane, as the injections of Ruyſch demonſtrate, inſomuch that they ſeem to conſtitute almoſt the whole ſubſtance of the muſcle. Theſe arteries are likewiſe accompanied with ſimilar ſmall veins, as alſo with nerves, throughout the whole ſubſtance of the muſcle. A contuſion of a muſcle may therefore break theſe veſſels, and extravaſate their juices in the cavities of the cellular membrane, where being collected, they may compreſs the adjacent veſſels. The extravaſated juices may be alſo cor-

rupted, and by their acquired acrimony, they may corrode the parts within their contact; whence inflammation, suppuration, gangrene, and the rest of the disorders that may thence follow. But suppurations arising from this cause are the worst of any, because the matter formed in the thin cellular membrane, which invests the muscular fibres, will make itself surprising passages, so as to run through all the tracts of this membrane, forming fistulæ and sinuses of the worst kind. Add to this, that the cellular membrane being consumed by a long suppuration, may give occasion for the fasciculi of muscular fibres, which it distinguished from each other, to grow afterwards together; whence the free motion of those fibres will be impeded, in their distention, by those causes which move the muscle, by which means the action of the muscle itself will be either depraved, or totally destroyed. Also the muscular fibres themselves, strictly so called, may be destroyed by a violent contusion; whence the muscular motion will cease, which depended upon the continuity of these fibres, and the muscle will become paralytic, which is an inability of any muscle to motion, with a flexibility and laxity of the affected muscle. But also a contraction of the limb may from thence follow, when the cellular membrane, which distinguishes the muscular fibres, being destroyed by a violent suppuration, occasions the fibres to grow to each other, so as to intercept the influx of their thinnest juices; whence a gradual contraction or shrinking of the muscle, which can be no more elongated by any distracting power, and from thence may arise surprising contractions, or distortions of the limbs; which may also proceed from the action of any muscle being destroyed, while the action of its antagonist prevailing, continually draws the limb towards its origin, where it at length stiffens: hence it is that a contraction of a limb so frequently follows an inveterate palsy.

But when muſcular fibres are ruptured by a contuſion, without deſtroying the action of the muſcle, it ſeems then to produce that very painful diſorder which the antient phyſicians called (σπάσμα) a pulling or (ῥήγμα) a rupture. Galen [a], treating of a contuſion, ſays, *Manifeſtum autem, quod parvæ venæ una cum carne dividuntur in ſuffuſionum* (ἐκχυμωμάτων) *generatione. Vulſiones* (σπάσμαλα) *autem fiunt circa fibras muſculorum amplius diſtentas, ut nonnullæ rumpantur, et vocant proprie juniores Medici hos affectus rupturas* (ῥήγμαλα). *Horum autem primus Hippocrates meminit, etc.* "But it is manifeſt, that the ſmall veſſels "are divided together with the fleſh, in the forma- "tion of contuſions (ἐκχυμωμάτων.) But contractions "(σπάσματα) are made upon the fibres of the muſ- "cles which are moſt diſtended, ſo that ſome of "them are broke; which diſorder is properly called "by ſome of the younger phyſicians (ῥήγμαλα) rup- "tures. But among theſe Hippocrates is the "firſt that remarks, *&c.*" Theſe ruptures are thus deſcribed by Hippocrates, [b] *Quibuſdam autem, cum imbecilles in carnibus aut venis vulſiones factæ fuerint, non ſuppurantur, ſed diuturni fiunt dolores, & vocant ruptiones* (ῥήγματα): "But ſome people having a weak "diſtention in the fleſh or ſmall veſſels, a ſuppura- "tion does not follow, but laſting pains are produced "which are called (ῥήγματα) ruptures." And in the end of the ſame chapter he adds, *Fiunt enim vulſiones à laboribus, et caſibus, et à plaga, et ſi quis onus majus tollat, et à curſibus, et luctâ et ejuſmodi omnibus:* "For contractions ariſe from hard labour, from acci- "dents, and from wounds, or when a perſon lifts "too great a weight; as alſo from running, wreſt- "ling, and all ſuch like motions." He ſeems alſo to have ſpoke of this in his Prænotiones Coacæ [c],

[a] Commentar. 3. in librum Hippocrat. de Medici officina text. 31. Charter. Tom XII. pag. 98.
[b] De morbis, Lib I. cap. 8. Charter. Tom. VII. pag. 541, 542.
[c] N°. 425. Charter. Tom. VIII. pag. 877.

where

where he says, *Vulsiones omnes quidem molestæ fiunt, et dolores in initio intensos producunt, et in posterum aliquos commonefaciunt, difficillimæ autem circa thoracem et maxime periculosæ:* "That all distractions are uneasy, and at first produce intense pains, but afterwards they give but slight uneasiness, being very obstinate, and the most dangerous about the thorax." But it must be observed, that in the translation they have rendered (σπάσματα) *convulsiones*, improperly; since these are called (σπάσμοι). But Galen [d] observes to us, that the muscular fibres thus divided are very difficultly conjoined again; for it was his opinion, that the ruptured fibres would easily enough unite, if the ecchymosis was speedily dispersed; but when that continued a long time, then the foul humours collected betwixt the ruptured fibres interposed, and obstructed them from uniting; so that from the great fatigue, fever, and less perfect digestion of the aliments with such like causes, the pain returned again. Perhaps there may be something of this nature in the muscles after violent straining, in lifting up great weights, &c. For severe and sudden pains then arise, which frequently torment the patient for a long time, and are exasperated by the least motion of body. Certain it is from experience, that an absolute rest of body is the chief remedy in these pains: and Hippocrates [e] directs, for the cure of these ruptures or distractions of the muscular fibres in the thorax, that the patient must abstain a year from labour; and in another place [f], after saying that this disorder arises from immoderate labour, he observes, that rest of body is highly necessary; otherwise the disease will return, and torment the patient worse than at first.

[d] Method. Medend. Lib. IV. cap. ultimo. Charter. Tom. X. pag. 102.

[e] De Morbis, Lib. II. cap. 24. Charter. Tom. VII. pag. 576.

[f] De Internis affectionibus, cap 9. Chart. Tom. VII. p. 644.

But

But if large nerves, &c.] If we consider the nerves in their origin, at the medulla oblongata and spinalis, they evidently appear very soft; and if the extremities of the nerves be also considered, in those parts where they deposite their integuments to form a sensitive organ, for conveying ideas to the mind by the new changes or impressions made upon them by external objects, how tender do they there appear! This is evidently demonstrated by the pulp of the auditory nerve, and in the retina of the eye, which last immediately collapses into a shapeless mucus, if it is not sustained by the equable pressure of the ambient humour. But these tender nervous threads are safely conveyed from their origin, to the extreme parts of the body, under the defense of tough coats and integuments. If therefore a large nerve should be contused in its course, the soft pulp-like substance of it may be injured, or even destroyed, while the integuments of the nerve appear uninjured; from whence all those functions will be destroyed, which resulted from the sound structure of the several smaller nerves, collected together in the large one. This appears evident in the experiment of Valsalva, mentioned in the commentary on § 276. numb. 5. For when he made a strict ligature with a thread upon the cardiac nerves of a dog, and removed the ligature soon after, the animal perished in a few days time, in the same manner as if these nerves had been divided, and yet there was no sensible injury appeared in the nerves, after death. For in this case the ligature so compressed the soft and pulp-like substance of the nerves, that the free influx of the spirits through them was wholly intercepted.

But why an incurable gangrene follows the destruction of a large nerve, and especially from an injury of the spinal medulla, we have already declared in the commentary on § 162, where some remarkable cases are alledged for confirming this doctrine.

SECT.

SECT. CCCXXVII.

EVEN a contusion frequently destroys or crushes the viscera themselves; and then follow an inflammation of them, a suppuration, a gangrene, scirrhus, and an injury of their functions.

What bad consequences sometimes follow after violent contusions of the head, by which the brain itself is injured, has been already observed in the history of wounds in the head. The viscera contained in the cavity of the thorax, are on all sides securely defended by the arched ribs, the sternum, and spina dorsi; and yet the wonderful case related at § 323, demonstrates, that even these viscera may be sometimes injured by contusions, since a fragment of the ribs lacerated the external membrane of the lungs, and produced a surprizing emphysema, with death itself. But the abdominal viscera are more liable to be injured by contusions; since they are for the most part covered only by the soft integuments and muscles of the abdomen; and though the spleen and the largest part of the liver are defended by the false ribs, yet have these viscera been sometimes so violently crushed by contusions, that death itself has speedily followed, as appears from the observations related at § 170. numb. 3. Nor will this appear wonderful, if it be considered that the substance of the liver and spleen is so tender, that unless great caution be used, they cannot be taken whole out of the dead body; from whence it is, that violent contusions of the abdomen so often prove fatal, in a small space of time. Parey [a] relates, that two boxers fighting, one of them being of a small stature, but thick and strong, forcibly threw down the other, who was very tall;

a Oeuvres d'Ambroise Pare. Apologie & Voyages, pag. 783.

whereupon

whereupon the tall one being enraged, took his elbow, and pushed it with the whole weight of his body against the scrobiculum cordis of his adversary, whereby the unhappy man instantly stretched out and expired. A large quantity of extravasated blood was found in the cavity both of the abdomen and thorax. There are innumerable observations to be met with in authors, from whence it appears that several of the viscera have been so injured from violent contusions, that death, and the worst consequences, have thence followed. For by this means the vessels may be ruptured, and their contained juices extravasated, which by putrefying may corrode all the adjacent parts; whence again may follow the very worst consequences, as inflammation, with all its attendants; namely, a suppuration, gangrene, &c. And since the functions of all the viscera depend upon the continuity of their vessels, and the regular motion of the juices through them, it is again evident, that those functions may be injured, or even totally abolished by contusions.

SECT. CCCXXVIII.

FROM hence (332 to 328,) it is easy to explain the many surprising and miserable symptoms and disorders, which usually follow from contusions (321); and an infinite number both of acute and chronical diseases may be thence predicted.

If now, what has been said at § 322. concerning the idea of contusion, with the inseparable effects of every contusion, enumerated at § 323, are applied to the several different parts of the body, which are capable of being injured by contusion, it will immediately appear what bad consequences are thence to be feared; which may be then safely predicted, from the known

known fabrick and uſes of the parts: as for example, if any one ſhould fall and ſtrike the right hypochondrium againſt a hard obſtacle, and ſoon after a conſiderable yellowneſs appears in the eyes and ſkin; it will be thence evident, that the bile being preſſed back, has infected the maſs of blood, and that therefore the region of the gall-bladder, and liver itſelf, have been injured by the contuſion. If again it be conſidered, that the ſubſtance of the liver is ſo very tender, that it reſembles a ſponge full of blood, there is great danger leſt a large quantity of blood ſhould be extravaſated from the ruptured veſſels, within the cavity of the abdomen; whence convulſions, faintings, and death itſelf, may often enſue, in a ſhort ſpace of time. But if the injury is ſlight, and only the ſmaller veſſels are ruptured, within the ſubſtance of the liver; even then the extravaſated humours may compreſs the adjacent veſſels, or elſe corrode them by putrefying, ſo as to produce an inflammation, ſuppuration, ſcirrhus, *etc.* in this viſcus; whence death ſlowly follows, after the patient has endured the greateſt miſeries. If the region of the loins ſhould be injured by a violent contuſion, and bloody urine follows, we know then that the ſmall veſſels of the kidneys are ruptured; whence again may follow the very worſt accidents: for the grumes of congealed blood eſcaping into the narrow paſſages of the pelvis and ureter, may wholly intercept the courſe of the urine from the kidney to the bladder; whence an inflammation of the kidney, ſuppreſſion of urine, *etc.* may follow. Even a ſmall particle of congealed blood, left in theſe paſſages, may form the baſis of a calculus, to which the earthy particles will on all ſides adhere; whence a train of new maladies again follow. If now it be conſidered that the like injury may happen in the other viſcera, it will be very evident that innumerable diſorders may thence follow, which will either kill the patient in a little time, by extravaſating the juices, and deſtroying the fabrick of the parts, whoſe

whose continuity is absolutely necessary to life, or otherwise, the patient may survive under the burden of diseases, from the injured functions of the parts, whence many chronical and often incurable disorders follow. This is demonstrated by an unlucky accident in a bold commander, who rushing against the enemy upon a fierce horse, that received a wound, the horse suddenly raised himself, by which means the pummel of the saddle was very violently pressed against the region of his stomach. A vomiting of much blood immediately followed; and as the noble person could not observe a proper regimen of life, and as he drank much wine, quite neglecting so great an accident, though he survived a considerable time, he was troubled with excruciating pains in his stomach, during life, tillat length a very troublesome vomiting, dysentery, &c. put a period to his miseries by death; and on opening the body, a large part of the liver, and the whole pancreas, were found cancerous. Thus also the worst maladies may follow from a contusion of the testicles. I saw a scirrhous testicle from this cause, which being imprudently treated with emollient and suppurating medicines, grew to such an uncommon bulk, that the scrotum with its included testicle nearly extended to the knee of the same side; and which was afterwards eroded by a frightful cancer, that occasioned death, after the worst calamities, in a person who was otherwise very healthy.

SECT. CCCXXIX.

A Present contusion, with the part it affects, is known, 1. by inspection, and by the touch; 2. by its effect, pain, numbness, heaviness, a change of the colour to red, brown, livid or like lead, black, yellow, or green, a hæmorrhage, gangrene, &c. (323 to 327); 3. by comparing

paring the ſhape and violence of the contuſing inſtrument, with the nature of the part injured.

This aphoriſm treats of thoſe ſigns by which a contuſion is known to be preſent, and by which the part affected is diſcovered.

1. For the veſſels being ruptured under the entire ſkin, their extravaſated juices fill and diſtend the panniculus adipoſus; whence a tumour and ſoftneſs of the contuſed parts appear to the eye and touch; and this more eſpecially in contuſions of the head, becauſe the hard ſkull occaſions the extravaſated juices to make the greater diſtention of the integuments outwards: which is elegantly expreſſed by Terence [a], where a procurer being heavily fined for his deſerts by a youth, ſays:

Omnes dentes labefecit mihi!
Præterea colaphis tuber eſt totum caput.

2. Pain attends almoſt in every contuſion; but when the contuſion, being very violent, has deſtroyed almoſt all the veſſels, there is then only a very obtuſe or no pain; but in ſuch a caſe there is a numbneſs, and a dull ſenſation in the affected part, which denotes that the ſenſible nerves are deſtroyed in the contuſed places, or are elſe ſo compreſſed by the extravaſated humours, and the contuſing inſtrument, that they remain no longer ſenſible. But as the extravaſated blood is generally collected under the entire ſkin, the colour of the contuſed part will be altered, according to the different quantity of extravaſated blood, and alſo according to the different time that is paſs'd ſince the contuſion was inflicted. For a ſlight contuſion is followed with a red colour, there being but little blood extravaſated, from a rupture only of the ſmaller veſſels; but yet that redneſs be-

[a] Adelph. Act. II. Scen. II. verſu 36.

comes

comes more obscure after a few hours, and inclines to black. But after a violent contusion, the colour of the part affected is often instantly changed to a leaden, livid, and frequently a black, from the large quantity of blood lodged under the entire skin; and although the colour was red at first, yet, by the exhalation or absorption which is afterwards made, of the thinner parts of the blood, the remainder turns black. But this leaden or livid colour of the contused part, ought not to give us any great surprize; for it is not always the mark of a gangrene, which may be easily distinguished by the coldness and elevation of the cuticle into vesicles, full of ichor, appearing in the morbid part. When the concreted blood begins to dissolve and be dispersed, then the leaden or black colour becomes gradually fainter, and begins to incline to red; and a yellow or greenish colour appears in the margin of the contused part, from the gradual dissolution and dissipation of the red part of the blood; which green or yellowish coloured margin is therefore a sign that the extravasated and concreted juices begin to be dissolved. It is well known, that when blood is drawn from the vein of a healthy person, it soon afterwards separates into two parts; the one a limpid serum, and the other a red concrete floating in the serum. If now all the serum is poured off, there will appear a considerable quantity more in a few hours time, as the red concrete gradually dissolves; so that by frequently pouring off the serum, almost the whole red part will at length vanish. The same dissolution seems to happen in these contusions, where the concreted blood is by degrees resolved into a thinner serum; from whence follows that change of colour in the contused part, when the extravasated blood begins to be attenuated and dispersed. This circumstance has been well observed by Hippocrates [b], where he treats of a fracture in the calcaneum; for he reckons it one of the best signs, denoting that there

[b] De Fracturis Textu 30 & 31. Charter. Tom. XII. page 205.

is no danger. *Si suffusiones (ἐκχυμώματα) & nigredines, & circumambientia loca subvirideſcant, ſine duritie. Optimum illud teſtimonium in omni ſuffuſione, &c.* "If in "contuſions the circumjacent parts look greeniſh, "without hardneſs and black ſpots. And that this, "ſign is of the beſt import in every contuſion," *&c.*

Unleſs a conſiderable wound is made in the ſkin, there ſeldom happens any profuſe hæmorrhage in a contuſion; for the blood extravaſated from the ruptured veſſels, being collected in the panniculus adipoſus, congeals and ſtops up the courſe of the blood, which is about to eſcape. But if the viſcera or larger veſſels are much injured by contuſion, a large quantity of blood may be extravaſated within the cavities of the body: as when, for example, the liver ſhall be thus injured; but then paleneſs, coldneſs of the extremities, great weakneſs, fainting, *&c.* ſufficiently denote ſuch an internal hæmorrhage. But when all the veſſels in any part of the body, are ſo deſtroyed by a violent contuſion, as to aboliſh all the vital influx and reflux of the juices, into and from the part, a gangrene or death of that part is then preſent.

3. We know a contuſion is preſent, when we are informed that ſome hard and obtuſe body in motion has ſtruck upon the part, or that ſome part of the human body in motion has been forced againſt ſome ſuch hard obſtacle. Hence a wound is frequently accompanied with contuſions, unleſs the wounding inſtrument was ſharp. At the ſame time too the nature and ſituation of the part injured muſt be alſo conſidered, as for example, that the viſcera of the thorax are leſs expoſed to injury by contuſions, and that the viſcera of the abdomen are more eaſily expoſed to the ſame injury.

SECT.

SECT. CCCXXX.

AND it is hence well known; 1. that an internal and large contusion, in one of the more noble viscera, is incurable; and must therefore occasion several diseases, and death itself. 2. That a contusion in the bones is very dangerous, and difficult to cure; especially when near their articulations or medulla. 3. That a contusion of the skull is worst of all, as we before demonstrated, from the vicinity of the brain. 4. That contusions of the larger glands seated at the ears, arm-pits, breasts, or the groins, uterus, pancreas, *&c.* threaten a scirrhus, cancer, and the disorders that may thence follow.

What prognosis ought to be formed, from a knowledge of the part injured by contusion, is made evident in this aphorism.

1. For the vessels being ruptured, will either produce a fatal hæmorrhage, uncapable of being suppressed; or else the contused parts must be separated by suppuration from the sound, as Hippocrates observes, in the place cited from him in the commentary on § 323; but from internal suppurations a consumption very frequently follows, which slowly destroys the unhappy patient. Besides this, since all the viscera have a share in constituting the health of the patient, therefore the function of the diseased viscus will be so much depraved after the suppuration, that if the patient survive, it will be in a miserable and diseased state. Now as these injuries by contusion happen more frequently in the liver and spleen, from the exceeding tenderness or friability of those viscera, it is very evident, that the worst consequences may be there expected, and that the cure will be extremely

difficult, the patient being very rarely reſtored to a perfect ſtate of health, becauſe more or leſs of a ſcirrhus almoſt conſtantly remains during life, which will diſturb the functions of the injured viſcera.

2. For a rupture of the veſſels, which afford life and nouriſhment to the lamellæ of the bone, will occaſion them to mortify and ſeparate; but if ſuch a contuſion is made near the articulations in the larger bones, there is ſcarce any room to hope for a ſeparation or exfoliation of the dead parts: becauſe in thoſe places the lamellæ of the bones recede from each other, and form cells, in which the blood-veſſels are diſtributed in great numbers, together with thoſe veſſels which contain the thin oil, which juices will be therefore corrupted by ſtagnating, and acquire a putrid acrimony, ſufficient to deſtroy the parts, whence a caries of the bone, and all the maladies that may thence follow. But if the medulla itſelf is injured, the very worſt or rancid acrimony thence follows, ſufficient to corrode the whole ſubſtance of the incumbent bone. See what has been ſaid in the commentary on § 325. To which add, that the bones cannot be contuſed near their articulations, without injuring the ligaments at the ſame time, which articulate the bones, whence excruciating pains, anchyloſes, &c. may follow.

Ligaments
See remark Page 31. I. I.

3. Of this we treated before, in the hiſtory of wounds in the head.

4. Conſult what has been ſaid in the commentary on § 324. In all the places here enumerated, there are very conſiderable glands ſeated, from a contuſion in which the very worſt maladies may follow. Among ten caſes where the breaſts are ſcirrhous or cancerous, nine of them are probably from contuſion. Agreeable to this, I ſaw an unhappy woman, whoſe child lying with her, with its whole weight upon her breaſt, made a contuſion with its elbow, by endeavouring to turn itſelf, whence a ſcirrhus followed throughout the whole breaſt, which was conſiderably tumified,

tumified, and in a few weeks time degenerated into a frightful cancer. The like injuries have been frequently obſerved in the parotid axillary and inguinal glands, ariſing from contuſion. But the uterus, in women who are not with child, is ſufficiently well ſecured on all ſides, by the bones of the pelvis; ſo that it cannot be eaſily contuſed, as it may in thoſe who are far gone with child, when the bottom of the uterus riſes up above the oſſa pubis: but the uterus may be alſo injured by the imprudent handling of the midwife, or by the difficulty of the birth; from whence a ſcirrhus of the uterus, degenerating into a cancerous ulcer, has been very frequently obſerved.

SECT. CCCXXXI.

IN the cure of a contuſion it muſt be always endeavoured to procure a diſcuſſion, to prevent a ſuppuration, and more eſpecially a gangrene.

Since the ſolid parts of the body are broken in pieces by contuſion, and the extravaſated juices are let into foreign parts; it is therefore required in order to a cure, to diſcharge the extravaſated juices, and to unite the ſolid parts which are divided. This will be moſt happily procured, if the concreted juices are rendered fluid; for then they may be abſorbed by the bibulous veſſels, and returned into the common courſe of the circulation. This method of cure is ſaid to be by reſolution or diſperſion. But a ſuppuration muſt be here avoided, if poſſible; becauſe by that means much of the ſubſtance of the contuſed part is deſtroyed, by a ſeparation of all that does not admit the circulating juices, from whence unſightly ſcars frequently remain; and the cellular membrane being conſumed after a violent ſuppuration, often occaſions

caſions the muſcles and tendons to adhere to the adjacent parts, whence their action is either depraved or aboliſhed. But it is certain, that a ſuppuration cannot always be prevented; though it is alſo equally certain, that ſome contuſions may be frequently removed or diſperſed, by the application of thoſe remedies mentioned in § 333, 334, by the neglecting or the too late uſing of which, it would certainly tend to ſuppuration. But it is very evident, that a gangrene ought to be ſtill more induſtriouſly avoided, as that wholly deſtroys the vital influx and eflux of the juices to and from the part affected; which being afterwards mortified, muſt be then ſeparated by ſuppuration, from the adjacent living parts.

SECT. CCCXXXII.

A Reſolution or diſcuſſion is procured by removing the extravaſated juices, without any farther injury to the veſſels.

It is a general indication in all contuſions, to remove the extravaſated juices; but if, for example, a diviſion of the contuſed part by inciſion, will give a vent to the extravaſated blood, this cannot be termed reſolution, becauſe the parts ſuffer a new injury. The ſame is alſo true, when the cure is performed by ſuppuration; for then the extremities of the injured veſſels are ſeparated, and diſcharged with the extravaſated juices, in the form of pus. But in order to a reſolution, it is required that no farther injury be offered to the parts, while the extravaſated juices are in the mean time carried off: and this is what Hippocrates [a] terms the drying up, or abſorpotion of extravaſated blood: for in treating of thoſe diſorders which follow a contuſion of the fleſh about the ribs, without a fracture of them, after deſcribing the pro-

[a] De Articulis textu 66. Charter Tom. XII. pag. 397.

per

per remedies, he adds, that a ſuitable bandage is neceſſary, ἕως ἂν ξηρανθῇ μεν, ἢ ἀναποθῇ τοῦτο τὸ ἐκχύμωμα, τὸ ἐν τῇ θλάσει γενόμενον: "But as for the blood which is "extravaſated in the contuſion, let it be dryed up "and abſorbed." But in what manner, and by what means, this reſolution may be obtained, is declared in the following aphoriſm.

SECT. CCCXXXIII.

BUT this reſolution is procured, 1. by rendering the juices fluid; 2. by relaxing the adjacent veſſels; and 3. by directing the juices into the veſſels, by evacuating them, and by frictions.

1. The blood extravaſated from the veſſels, immediately concretes, and by that means is rendered unfit both for paſſing through the ſmaller blood-veſſels, and for being abſorbed by the mouths of the veins. The firſt thing therefore required, is, to render the concreted juices fluid. For if the extravaſated juices can be reduced to the tenuity of water, they will certainly be diſperſed, provided the body is healthy in other reſpects. Hippocrates[a] pronounces, *Carnes attractrices ex cavo, & extrinſecus:* "That the fleſh attracts "or abſorbs, both from within and without." And he alſo acknowledges the whole body to be perſpirable, or exſpirable and inſpirable. The extravaſated juices will be therefore abſorbed by the bibulous veins, which open in all the larger and ſmaller cavities of the body, provided it be ſufficiently attenuated to enter them.

2. All the attenuated juices which are to be abſorbed, muſt enter the exceeding ſmall bibulous veins, and be conveyed by them to the larger branches. Now it appears from inconteſtible experiments, that

[a] Lib. 6. Epidem. in initio. Charter. Tom. IX. pag. 540.

any of the ſmalleſt tubes, made of the pureſt glaſs, by drawing out at a lamp, upon having one end immerged in any liquor, will attract the liquor into their cavity; and that the liquor will aſcend higher into the tube, as it is of a ſmaller bore, and more inclined from the perpendicular, towards the horizon; but the moſt of all when one end of it is inclined lower than the other, for then the attractive force, by which the liquor is drawn into the tubes, is aſſiſted by gravity. The like action ſeems to obtain, when the extravaſated humours being firſt attenuated, enter the exceedingly minute tubuli of the abſorbing veins. But the valves which are conſpicuous in the ſmalleſt lymphatic veins, prevent their contained humours from reſiſting the ingreſs of the abſorbing juices. Now flexible canals are the more eaſily filled, in proportion as their ſides give a leſs reſiſtance; and therefore relaxation of the adjacent veſſels facilitates the courſe of the abſorbed juices, through the exceedingly minute ducts, into the larger venal branches, which is here required.

3. The juices thus abſorbed by the minute venal ducts, will go on more eaſily through the large venal branches, as they contain leſs humours to be moved; provided the powers, which promote the motion of the venal blood, remain the ſame; *viz.* principally the pulſation of the arteries, contiguous to the veins, with the motion of the muſcles; for the muſcles ſwelling in their action, compreſs the adjacent veins, and drive the blood through them towards the heart. If therefore the maſs of humours to be moved is diminiſhed, and the moving powers remain equally ſtrong, it is evident that the veins will be more ſpeedily evacuated, by which means the juices to be abſorbed by the minute bibulous ducts, will have a more eaſy entrance. This doctrine is alſo confirmed by experiments; for when men travel in the ſcorching ſun, having their bodies rough, and their mouths parched up with excruciating and burning thirſt, they have

have been ſurprized to find their thirſt extinguiſhed, and their mouths moiſtened, after bathing, which has rendered the whole body ſo moiſt and ſoft, that none of the former roughneſs appeared. This is an experiment produced by Galen [b], to prove, that the whole body is inſpirable. For by violent exerciſe in a very hot air, many of the thin juices are exhaled from the body, by which means becoming very dry and bibulous, it eagerly abſorbs the water contiguous to its external ſurface. Perhaps it may be from hence that the body is filled with watery humours, after great loſſes of blood, when the ſmall abſorbing veins very eaſily diſcharge the abſorbed humours into the larger empty veins: but in the mean time, the ſtrength being weakened, and the heat of the body diminiſhed, occaſions the thin watery juices to be accumulated in the larger and ſmaller cavities of the body, which are ſaid by Hippocrates to contain ſpirits in a healthy ſtate, and ichor in a diſordered ſtate, as we obſerved in the paſſage before cited in the commentary on § 323. And perhaps from thence may be deduced the reaſon why dropſical patients ſo ſoon ſwell again, after all the water has been diſcharged by paracenteſis, or any other way, even though they abſtained from drink: for notwithſtanding a very large quantity of water is collected in the cavities of the body of the dropſical patient, yet the reſt of the veſſels collapſe, and are evacuated, whence the reſt of the body conſumes in proportion as the abdomen is diſtended in an aſcites, whence the body becomes more bibulous.

But frictions, with a gentle compreſſion, act more upon the veins than upon the arteries; becauſe the coats of the veins are thinner, whence the veins will be emptied; and as there is an alternate compreſſure and relaxation of the parts, in all frictions the veins will by that means be firſt emptied, and then directly filled

Veins they are also much more superficial & consequently more affected by friction, than the arteries which by deeper. I.d.

The Capillary Arteries are equally superficial with the Veins. Sanctorius

[b] Commentar. in Lib. 6. Epidem. Hippocr. Charter. ibid. pag. 541.

filled again; so that frictions will produce much the same effect with evacuations; namely, by emptying the vessels, they will facilitate the ingress of the juices, to be absorbed through the small mouths of the bibulous veins. Add to this, that the extravasated and concreted blood itself, will also be attenuated and resolved by the friction: for if the blood which has been taken from the vein of a healthy person, and congealed in the open air, be ground in a glass mortar, it will be again dissolved into a frothy and red coloured liquor; and therefore frictions are evidently of the greatest use in the cure of convulsions.

SECT. CCCXXXIV.

THerefore plentiful blood-letting, with the exhibition of a cooling purge, that acts briskly without inflaming; the application of discutient, relaxing, and penetrating fomentations to the part itself, with warm frictions, and the internal use of attenuating, sudorific, and diuretic medicines, will be here serviceable.

In this aphorism are enumerated the most efficacious remedies, for answering the curative indications proposed in the aphorism preceding.

Plentiful blood-letting.] For this is one of the chief remedies in all contusions, provided the patient is strong; and therefore it ought to be boldly used, and repeated as may be found necessary. Thus an intense fever and inflammation, which are the most to be feared in these disorders, may be prevented; because the grossest parts of the juices, namely, those of the red blood, are thus evacuated from the vessels, and an easy passage given to the thinner juices taken into the body. At the same time also, the depletion of the larger veins by phlebotomy, will facilitate the absorp-

abſorption, and the tranſmiſſion of the juices imbibed by the ſmalleſt veins, towards the larger branches, whence the extravaſated blood will be more readily diſperſed.

With the exhibition of a briſk purge ſoon after, that will not inflame.] Thoſe medicines which are called purgatives, do not only evacuate thoſe humours, which before exiſted under the ſame form within the body, as they appear in at their diſcharge; but they alſo diſſolve the healthy juices, and evacuate them from the bowels when diſſolved, as was proved in the commentary on § 201. And from hence Eraſiſtratus and his followers rightly concluded, *Purgationes eſſe evacuationes una cum corruptione & immutatione illorum, quæ evacuantur:* "That purging is an "evacuation made with a corruption and alteration "of the humours evacuated." Galen [a] indeed eſpouſes the contrary opinion; but this ſeems to be truly the caſe. For ſcammony being given to the moſt healthy perſon, ſo diſſolves the ſound juices, that being melted into a thin water, they are diſcharged by ſtool in an incredible quantity; and if the uſe of the ſame medicine be frequently repeated, the whole body will be emaciated, the veſſels will collapſe, and extream weakneſs will follow. All which ſufficiently evince that the juices were not evacuated, as exiſting before in a morbid ſtate, but that the ſound humours are expelled from the body, after they have been diſſolved into a thin and fœtid water, by the force of the medicine. By theſe remedies therefore the veſſels are emptied, and the humours diſſolved, while at the ſame time the ſmall veins are rendered extremely bibulous; as they open throughout the whole external and internal ſurface of the body, which is evident from a remarkable experiment. A young man having a fever, attended with a diarrhœa and a great ſtupidity of his ſenſes, would not take any thing by

[a] Galen. de purgant. Medicam. facult. cap. 2. Charter. Tom. X. pag. 464.

the mouth; though the fever in the mean time continued to dry up the body by its heat: hereupon the phyſicians ordered his feet to be immerged in warm water; which being done, a ſurpriſing conſumption of the water in the veſſel was ſpeedily obſerved, and ſoon after followed an impetuous diſcharge of the ſame water, almoſt uncoloured, by the anus [b]. Hence it is evident, that theſe purges very well ſatisfy the indications of the firſt and ſecond number of the preceding aphoriſm: for the humours are thus diſſolved, the veſſels evacuated, and that power encreaſed, by which the juices are abſorbed by the bibulous veins.

But it muſt be at the ſame time remarked, that thoſe ſtrong purges are not uſeful in this caſe, which act by exciting violent motion, ſuch as the colocynthis, euphorbium, *&c.* but ſuch only are here uſeful, as having a power to diſſolve the juices, do notwithſtanding produce their effects without much diſturbance; as ſcammony, jalap, leaves of ſena, *&c.* of which various forms are prepared in the *Materia Medica Boerhaaviana.*

Penetrating fomentations, *&c.*] As the extravaſated blood lies generally congealed, under the entire ſkin of the contuſed part; it ought therefore to be rendered fluid in ſuch a manner, as to prevent it from putrefying at the ſame time. Now congealed blood gradually diſſolves, barely by expoſing it to the open air, but then it alſo putrefies; and therefore it is neceſſary for theſe fomentations to have a power of reſiſting putrefaction, as well as of attenuating and diſſolving. Such a fomentation may be made of ſal ammoniacum, or ſea-ſalt, diſſolved in twenty times as much water, with the addition of a fourth part of wine, and an eighth part of vinegar, which being applied warm, will anſwer all theſe intentions. For the water in it relaxes, while the ſalt, wine and vinegar, prove good diſſolvents, and at the ſame time prevent

[b] De Re Medica diſſertat. quatuor Thomæ Simſoni, pag. 183.

any

any putrefaction. The urine of a healthy person, mixt with a small quantity of vinegar, composes a fomentation of the like nature; with which those tumours of the head are happily discussed, which so frequently result from contusion in children.

Several medicinal simples may be also infused in the water, for this purpose, in which there is a power of dissolving; and the form of such a fomentation may be seen in the *Materia Medica* of our professor. Various emplaisters are also adapted to this intention, which may be seen enumerated in the *Materia Medica* corresponding to this aphorism. These last, while they adhere to the skin by their tenacity, restrain the most subtle juices from exhaling, and repel them in a manner to the part upon which they are applied; so that the part affected continues as it were in a bath of its own vapours, which relaxes the vessels; and then the aromatic or fragrant particles of the emplaister insinuating themselves into the relaxed vessels, frequently produce the desired effect, when fomentations are not so serviceable, unless they are continually retained warm upon the affected parts.

Warm frictions upon the part.] If no inflammation nor any great pain appears in the contused part, gentle frictions are extremely useful. For by this gentle agitation, the concreted blood is attenuated and divided, so as to be capable of returning through the small mouths of the bibulous veins. At the same time also the veins are thus emptied, so as to facilitate the motion of the absorbed humours through the depleted vessels, as we said before in the commentary to the preceding aphorism. Thus a man being abused by his enemies, had his whole face frightfully tumified by contusion, which was happily dispersed by these fomentations, joined with continual and gentle frictions, insomuch that no manner of suppuration followed in the tumour, and his face recovered its former shape, which could be hardly expected.

Internal attenuating medicines, &c.] Thoſe medicines which reſtore the concreted parts of a fluid, to the ſame ſtate of fluidity which they poſſeſſed before concretion, are termed attenuants or reſolvents. Among theſe, warm water has the chief place; partly inaſmuch as it dilutes, by inſinuating itſelf betwixt the concreted particles; and partly, becauſe it is the vehicle that diſſolves all other medicines, concerning which you may conſult what has been ſaid before in the commentary on § 54. numb. 4. Phlebotomy therefore being premiſed, with the uſe of thoſe antiphlogiſtics or cooling purges, which powerfully diſſolve the humours, without putting them into any violent commotion; it will be next moſt convenient to give a large quantity of ſome decoction which contains much water, repleniſhed with ſuch particles, as may by a gentle ſtimulus excite the veſſels, to act a little more powerfully upon their contained juices; and alſo, that the unactive water may not be retained or accumulated within the body, obſerving likewiſe to chuſe ſuch ingredients as reſiſt putrefaction. Hence it is that the infuſion of ſcordium, rue, horehound, &c. with the five opening roots, the three ſorts of ſanders, nitre, honey, &c. are ſo very ſerviceable in theſe caſes. For when the veſſels, being firſt depleted by phlebotomy and the uſe of purges, are continually filled by drinking theſe decoctions warm, while at the ſame time the contuſed parts are continually treated with fomentations and gentle frictions, ſo as to derive the action of the internal medicines to the injured part, (for which ſee the commentary on § 134.) every thing is then done that can be expected from art. For then warm water, repleniſhed with the diſſolving virtues of the preceding remedies, will every moment be conveyed to the extravaſated humours, which will be thus diluted, diſſolved, and rendered fit to return into the ſmalleſt veins; ſo that all the extravaſated juices are thus carried off, without further injury, which is required by the intention.

But

But ſince all theſe remedies, taken in large quantities, are uſually again diſcharged from the body, either by a diaphoreſis, or by the urinary paſſages; therefore ſuch a diſcharge is to be performed, by a ſudorific regimen: as when a perſon is on all ſides encompaſſed with a warm atmoſphere, by lying in a bed, well covered, which will excite a ſweat; but if the patient remains in a cold air, that generally occaſions a more copious diſcharge by urine.

SECT. CCCXXXV.

THE order of which remedies, with the neceſſity of repeating them, and in ſuitable doſes, is determined by (334), with the dangerouſneſs of the caſe.

There is no neceſſity to uſe all theſe aſſiſtances of art, in every contuſion; for ſlight accidents of this kind may be removed barely by the uſe of fomentations, compoſed of urine, ſalt, vinegar, and the like: but when there is danger of a violent inflammation with a ſtoppage of the circulation, and a gangrene; then all the forementioned remedies are to be brought into uſe. In that caſe therefore we are to begin with phlebotomy, uſing it liberally, if the patient's ſtrength will permit; and in the next place to give the forementioned purgatives, that by diſſolving the humours, and weakning the vital powers, the body may be far from being inclined to inflammation or fever. If the tumour, pain, and inflammation do not yet diminiſh, by the uſe of theſe means, they are to be boldly repeated, eſpecially when the contuſion has injured ſome internal part; for then the worſt conſequences may be feared, from a ſuppuration, or elſe an incurable ſcirrhus may remain, from the imperfect cure of the diſorder, which may terminate in a cancer, and produce the moſt grievous ſymptoms.

toms. But when the ſymptoms diminiſh by the uſe of theſe means, then, if the affected part is acceſſible to the hand, gentle frictions will be extremely uſeful; and not before: for the tenſe and inflamed parts, diſtended by the extravaſated humour, may by a rough friction be rather excited to a ſpeedy gangrene.

SECT. CCCXXXVI.

AT the ſame time alſo a very thin diet, of aliments the leaſt apt to putrefy, is here required.

For the intention requires to dilute plentifully all the juices, and to ſupport life in ſuch a weak ſtate, that there may be no danger of inflammation; and as the extravaſated humours are ſpontaneouſly inclined to putrefaction, therefore a diet of ſuch aliments is to be choſe, as will reſiſt that kind of alteration in the juices. Hence a decoction of barley, oats, rice bread, and the like, in milk and water, with boiled apples, and other ripe garden fruits, are here highly recommended; alſo weak fleſh broths boiled with rice or barley, and mixed with a little citron juice, are likewiſe equally ſerviceable. Nor is there any danger that this weak aliment will not be ſufficient to ſupport life; for the human body at reſt, may be ſupported even by the pooreſt nouriſhment. This is what the celebrated Boerhaave has experienced in himſelf, when being tormented by the moſt ſevere pains in a rheumatiſm, he lived for the ſpace of twelve days only upon whey; and yet he continued in good ſtrength, ſufficient for exerciſing the muſcles, if the pain had not oppoſed. But the body being weakened by bleeding, and the uſe of purges, cannot act ſo powerfully upon the ingeſted aliments, to change them into its own nature; whence the aliments will be more

more easily inclined to degenerate spontaneously according to their own nature. But as a putrefaction is to be feared in the extravasated juices, therefore such aliments are principally recommended in the diet, as have naturally a greater inclination to acidity; and for the same reason likewise, flesh, eggs, fish, and the like, are to be avoided. But all acrid sauces, spices, and the like, are pernicious, by increasing the motion of the circulation, which ought in this case to be rather weaker and more sedate. But in all these cases a regard must be likewise had to the season of the year, with the healthy or morbid constitution, and custom or course of life in the patient, *&c.* concerning all which you may consult what has been said in the commentaries on § 192 to 196.

If all that has been said concerning the diet and remedies afforded by pharmacy and surgery be duly observed, they will be always attended with success when the disorder is curable; but all other boasted specifics for contusions ought not to be trusted to alone for the cure of the disorder, though many of them are innocent, and may be used, provided the forementioned very efficacious means are not neglected. Thus Helmont [a] recommends the dried blood of a goat, that follows after cutting off his testicles, which he would also have to be given to such as fall from high places, in order to disperse the concreted blood in the contusion. Others recommend sperma ceti, a decoction of madder, *&c.*

SECT. CCCXXXVII.

BUT if the contusion is so large that it cannot be resolved, and is at the same time accessible to the hands, a scarification, incision, or suppuration must take place, observing what has been said in (334.) Or else, if the contusion is

[a] Ortus Medic. in Capit. Pleura furens, pag. 322. n°. 32.

ſo great as totally to deſtroy the life of the part, or is ſo conditioned, that one may thence certainly foreſee, that intolerable pains, inflammations, a ſuppuration, conſumption, fever, or death itſelf will follow, an amputation ought then to be timely made, when that is practicable, (464 to 475).

When the injury is ſo great that one can by no means hope to diſperſe the extravaſated juices, without further damage to the veſſels, the only remedy that then remains, when the contuſed part is acceſſible to the hand, is to make an opening for the diſcharge of the extravaſated juices, and then to deterge the parts by a mild ſuppuration, ſo as to reduce them to the ſtate of a clean wound. For if this method is not taken, the extravaſated juices compreſſing the adjacent veſſels, may occaſion an inflammation, or by wholly ſuppreſſing the vital circulation in the part, a gangrene may follow, which, if attended with a putrefaction, may occaſion ſtill worſe conſequences. In this caſe then the contuſed part is to be entirely divided, or elſe punctured in many places, by ſcarifying with a lancet, to give a free diſcharge to the extravaſated humours; and then the ſubjacent living parts, being ſet at liberty from the compreſſure, will expel and caſt off all that has been ſo injured by the contuſion, as to be no longer obedient to the laws of the circulation. But this ought more eſpecially to be performed, when very dangerous conſequences are to be feared from an inflammation or eroſion of the adjacent parts, as was obſerved before in the hiſtory of wounds in the head in § 243, 244, 248.

But notwithſtanding the difference of the caſe, the remedies mentioned in § 334. ought not to be here neglected; for if the inflammation proves too violent in the contuſed part, it may produce a gangrene inſtead of a laudable ſuppuration. Therefore phlebotomy and cooling purges are here highly uſeful,

ful, joined with thoſe fomentations which reſtrain putrefaction: and at the ſame time it will be always uſeful to give large quantities of the attenuating decoctions, that all ſuch parts of the corrupted juices or purulent matter, which have infected the maſs of blood by returning through the bibulous veins, may be diſcharged from the body, either by a diaphoreſis or the urinary paſſages. As it appears from what has been ſaid before, that the extravaſated blood may be ſo attenuated, as to be abſorbed by the bibulous veins; ſo alſo may the matter or corrupted ichor return the ſame way, and infect the blood, ſo as to produce a very bad ſtate of the juices; from whence again various bad conſequences may follow.

But when a violent contuſion has ſo injured the larger veſſels, or has ſo far deſtroyed the fabrick of the part, that the vital circulation of the juices through the part is no longer continued, a perfect blackneſs or mortification thereof follows, which deſtroys them all. In that caſe there is but one remedy remaining; namely, to extirpate the part to preſerve the life of the patient. That this is the ſtate of the diſorder, may be known, if no warmth nor any ſenſation remains in the contuſed part, even though it be deeply ſcarified; and a putrefaction ſpeedily following affords a cadaverous ſmell. If now the part thus affected be not ſpeedily extirpated, by the ſpreading of the ſphacelus, the patient will be ſoon deſtroyed. Such a caſe happened to an expert coachman, who in breaking ſome unruly horſes fell off of the chariot by their running away, whence his legs being unhappily twiſted in the wheels were cruſhed to pieces in ſuch a manner, that neither ſenſe nor warmth any longer remained in the parts; but as this man would not admit them to be amputated, which was here abſolutely neceſſary, he therefore expired on the fourth day after. The ſame is alſo true, if the bones are ſo fractured by a violent contuſion, that they ſeparate into ſmall fragments or ſplinters, which, by pricking and

irritating the nervous parts, may produce the moſt ſevere pains, violent inflammations, and the bad conſequences which may thence follow. A man had his right hand ſo violently contuſed by the falling of a caſk of wine, that the bones of the metacarpus, which ſuſtain the index, middle, and ring finger, were cruſhed to pieces, together with the adjacent muſcles and veſſel. The celebrated ſurgeon employed affirmed, that there was no remedy remaining but an extirpation of the contuſed parts; and that if the operation was neglected, a train of the worſt ſymptoms would ſoon follow. But yet the wounded patient was unwilling to ſuffer the operation, and notwithſtanding the beſt remedies were applied for the ſpace of two or three days, the pains were very ſevere, the inflammation ſo violent, and the tumour ſo large, that it evidently appeared a gangrene would ſoon follow; but the contuſed parts being then immediately amputated, the patient was happily cured [a]. But how much may be effected, even in the moſt deſperate caſes, by an intrepid courage in the patient, with great ſkill and dexterity in the ſurgeon, may appear in the following hiſtory taken from the forementioned author [b]. A captain of a ſhip of war had his whole arm, by an unlucky accident, ſo miſerably contuſed, even up to the ſhoulder, that neither ſenſe nor warmth remained throughout the whole limb; and although a true ſphacelus had already ſpread itſelf beyond the ſhoulder, and the whole arm corrupted with a cadaverous ſtench, the ſurgeon confiding in his art, and the patient full of courage, preferred a doubtful remedy before certain death; whence the limb was immediately amputated in the articulation, and nature, being afterwards aſſiſted with proper remedies, ſeparated the reſt, which was already corrupted; ſo that in two months time he returned ſafe to his friends, ſnatch'd in a manner from the jaws of death.

[a] De la Motte Traité complet de Chirurgie, Tom. III. pag. 247.
[b] Ibid. pag. 408.

SECT.

SECT. CCCXXXVIII.

BUT more may be performed by the preceding method (331 to 336) than any one would imagine; becauſe nature herſelf is always ready to aſſiſt towards a ſpontaneous ſeparation, attenuation, reſolution, diſperſion, and expulſion in the parts injured.

But yet recourſe ought not to be had immediately to amputation, ſince the moſt faithful obſervations teach us, that ſuch diſorders have been ſometimes happily cured, though they have ſeemed altogether deſperate. Therefore it ſeems to be moſt adviſeable always to make trial firſt of the methods propoſed in the aphoriſms here cited, whenever that may be ſafely done; and in the mean time we are furniſhed with ſeveral remedies, by which the parts, even though mortified, may be ſo preſerved, that the putrefaction will not eaſily ſpread; ſuch as *alliaria*, *ſcordium*, *marrubium*, *ſalvia*, *ruta*, *&c.* which being infuſed in water, with the addition of ſalt, urine, and vinegar or ſpirit of wine, form a fomentation, which being applied warm both by day and night, certainly reſtrains all putrefaction; ſo that one may ſafely wait a few days to ſee whether nature will attempt a ſeparation, or whether any ſigns appear of life returning again into the part. Thus our celebrated profeſſor is uſed to tell his audience, that a German nobleman belonging to this univerſity was flung out of a chaiſe, and the wheels running over his legs, miſerably fractured the tibia and fibula of each leg, with a frightful laceration of the adjacent parts, which, though invaded by an incipient gangrene, were cured by the uſe of theſe remedies. There is alſo a ſurpriſing inſtance related in the obſervations of the celebrated Le Motte [a], of a young

[a] De la Motte Traité complet de Chirurgie, Tom. III. pag. 405.

man who received such a violent blow upon the anterior part of his right arm, that a violent contusion appeared to extend itself from the cubitus to the carpus, attended with extreme pain: the patient had applied linen cloths dipt in spirit of wine, but perceiving scarce any relief from thence, was obliged to have recourse to a surgeon. The pain had now almost vanished in the hand, but was more violent in the cubitus; the affected hand appearing pale and quite cold, and the skin being roughly handled, came off from the ends of the fingers. No pain was perceived in the hand, even by deep scarifications made with a lancet; nor did so much as a drop of blood follow, after thrusting a lancet quite through the hand; and this coldness and insensibility extended to the middle of the cubitus. The parts were fomented with spirit of wine mixed with salt and unguent. Ægypt. and at the same time a cataplasm was applied composed of barley-meal, with the flower of beans and lupins, mixed with spices and wine; by the use of which remedies the warmth and sensation returned down to the carpus, the whole hand as yet remaining cold and senseless; and though it had continued thus for the space of five days, was neither fœtid nor black coloured. Scarifications being again made in the hand, warm oil of turpentine was afterwards applied, and then the other remedies as before for the space of five days more without any alteration in the parts; but from that time the warmth and life began to return, and the patient was happily cured without any amputation, only two of the fingers remained afterwards contracted, with a stiffness in the rest. Since therefore the contused part could be thus preserved in so desperate a case, it seems to be the duty of a prudent surgeon or physician not to have recourse to amputation, unless all other means have been tried without success. For if the force of the blood may be so abated by phlebotomy and the use of other remedies, that there is no danger of an inflammation or gangrene

grene from the contuſion, and at the ſame time ſuch applications are uſed externally, as reſtrain putrefaction, joined with a thin diet, not at all inclined to putrefaction, there is great room to hope that the corrupted parts will be ſeparated from the living, and that the loſt ſubſtance will be afterwards regenerated.

Of Fractures.

SECT. CCCXXXIX.

IF the parts of a bone are violently ſeparated from their coheſion into large fragments, it is called a fracture.

Hitherto, we have been treating of a ſolution of continuity in the ſoft parts of the body, and we come now to conſider the ſame diſorder in the bones. But a ſolution of continuity in a bone is by the Latins diſtinguiſhed by the name of *fractura*, called by the Greeks [a] κάταγμα; though a ſolution of continuity made in the cartilages has never obtained a diſtinct name, but is comprehended under the title of fracture; at leaſt Hippocrates [b] uſes this name in treating of fractures in the joints, which are wholly cartilaginous, where he ſays, ἢν ᾖ ὀς κατεαγῇ, &c.

But it is cuſtomary not to term every ſolution of continuity in a bone a fracture, but only that which is made by ſome external violence, as Ægineta [c] obſerves, where he ſays, *In univerſum autem fractura eſt divulſio oſſis, vel ruptura, vel diſciſſio à quadam vi externa facta*; "But in general a fracture is either a "divulſion, rupture, or cutting aſunder the parts of "a bone made by ſome external violence." For

[a] Galen. Meth. Med. Lib. VI. cap. 5. Charter. Tom. X. pag. 143.
[b] Hippoc. de Articulis, Text. 48. Charter. Tom. XII. pag. 361.
[c] Lib. VI. cap. 89. pag. 96. verſa.

thus a fracture is distinguished from a caries of the bone. It is also added in this definition, that it is called a fracture when one part of a bone is separated from its cohesion with the other, in order to distinguish it from a luxation, in which the naturally contiguous bones are removed from each other. But then to distinguish a fracture from a contusion, which supposes a crushing of the solid parts (*vide* § 322.) it is added in the definition, that the disorder is called a fracture, when the parts of a bone are separated into *large fragments*. But notwithstanding this, the antients refer a comminution of a bone into very small fragments, to the head of fractures, provided it arose from some external violence; and such a species of fracture they called ἀλφιτιδον [d].

SECT. CCCXL.

WHICH division of the bone being single, and by itself, denominates the fracture *simple*; but when there are several divisions of the bone, it is a *compound* fracture; or if accompanied with a wound, contusion, inflammation, an ulcer, or many fragments, it is then called a *complicated* fracture.

Surgeons usually distinguish fractures into three species, *viz.* simple, compound, and complicated. A simple fracture is said to be, when a single bone is only fractured in one place, without any considerable injury of the incumbent parts adjacent. But when such a fracture happens in any part of the body, where two large bones lie by the side of each other; as for example, in the cubitus; if the radius only is fractured, without injuring the ulna, that species of fracture is then termed incomplete, by some surgeons; because the situation of the parts is not then much

[d] Lib. VI. cap. 89. pag. 66. versa.

disturbed,

disturbed, and the limb retains its proper length: but when the ulna and radius are both fractured together, or the tibia and fibula in the leg, they then call the fracture complete, or even compound; though it would also seem that a fracture may be termed compound, when only a single bone is fractured in several places. But when a fracture of one or more bones is also attended with symptoms that require a distinct treatment, such as a wound, ulcer, *&c.* it is then termed complicated; because a particular regard must be then had to those concomitant disorders, during the cure of the fracture. But it is very evident, that a fracture ought not to be termed complicated, unless those symptoms are very severe; for no fracture can be made without some degree of contusion, and a slight inflammation almost constantly attends a fracture. Hence it follows, that a fracture is only to be termed complicated, when those concomitant disorders are so considerable, as to require a distinct treatment, or a different method of cure from that which is sufficient in a simple or compound fracture; as, for example, when a fracture is accompanied with a large wound, the same bandage cannot be applied as in a simple fracture, where the dressings may continue upon the part for several weeks; but such an apparatus is required as may be easily removed, for the dressing of the wound, without hazarding a fresh division of the fractured and reduced bone.

SECT. CCCXLI.

NOW according to the different course of the fracture, it is also termed, either transverse, oblique, or longitudinal; and according to the fragments, pointing against, or pressing laterally upon each other; and according to the protuberant spines that arise, the fracture takes a different

different name and method of cure, as it acquires a different nature.

Fractures again acquire different names according to their different courſe or ſituation. A tranſverſe fracture is when the bone is divided in a direction perpendicular to its length, being that ſpecies of fracture which our ſurgeons in Holland call *radyſbreuk*, or a breaking ſhort off like a ſtick; and the like term we alſo meet with among the antient Greeks, taken from the ſimilitude of a broken ſtick or ſtalk, *viz.* καυληδὸν κάταγμα [a]; namely where the parts of the bone tranſverſely fractured, entirely depart from each other, without any further coheſion. Hence this kind of fracture is alſo termed ῥαφανηδὸν and σικυηδὸν by Ægineta [b], from the ſimilitude of a broken radiſh or cucumber. Hence alſo Hippocrates [c] ſeems to have uſed in the ſame ſenſe the word ἀποκαυλισθῆναι, where he ſays, ἢν δὲ καταγῇ ἡ κάτω γνάθος, ἢν μὴ ἀποκαυλισθῇ παντάπασιν, ἀλλὰ ξυνέχηται τὸ ὀστέον, &c. *Si vero inferior maxilla frangatur, nec autem omnino tranſverſim fracta fuerit, ſed cohæreat os, &c.* "But if the lower jaw is "fractured, the fracture not being quite tranſverſe, "but the bone yet adheres, *&c.*" where it manifeſtly appears, that τὸ ἀποκαυλισθὲν is uſed in oppoſition to τῷ συνεχεῖ.

Oblique.] Namely, when the diviſion of the bone is not perpendicular to its length, but inclined either to one ſide or the other; by which means the fracture acquires a larger ſurface, and the fragments are more difficultly retained together, after they have been reduced.

Longitudinal.] Namely, when the bone is ſplit according to its length, whence it may be rather termed a fiſſure than a fracture; becauſe the parts of

[a] Galen. Method. medendi, Lib. VI. cap. 5. Charter. Tom. X. pag. 143.

[b] Lib. VI. cap. 89. pag. 96. verſa.

[c] De Articulis Textu, XXV. Charter. Tom. XII. pag. 342.

the

the affected bone are in this case seldom entirely separated from each other, but remain slit as it were in a right line, which species of fracture is therefore called by the antients κλιδαχηδὸν [d], or a division of the bone according to its length [e].

According as the fragments, &c.] For the fractured extremities of a bone may either continue in their natural situation, especially when the fracture is transverse; or else they may be a little displaced, so, however, as to remain partly in contact with each other; or lastly, the fragments may be wholly separated from each other, and recede to either side, which is almost constantly the case in oblique fractures, and sometimes also in transverse; but if the fragments are also sharp pointed, they may run through the integuments like thorns, which is certainly the worst species of fractures.

But it is necessary to attend carefully to all these different circumstances, not only for distinguishing fractures by their different names, but because their different nature requires a different treatment, and a better prognosis may be thence formed of the bad consequences which may be expected to follow.

SECT. CCCXLII.

THE effects of a fracture are different, according to the particular nature of the fractured bone, and the different manner in which the fracture is inflicted, with the various condition of the fragments, as to their situation, figure, number, magnitude, &c. and lastly, according to the different nature of the adjacent parts, and of the part itself, in which the fracture happens.

[d] Galen de Method. medend. Lib. VI. cap. 5. Charter. Tom. X. pag. 143.

[e] Ægineta, Lib. VI. cap. 89. pag. 96. versa.

The

The first consequence of a fracture, is an injury of all the functions which resulted from the continuity of the bone, and then follows a disturbance in the actions of the adjacent parts, which are either compressed or injured by the bony fragments. Hence it is very evident, that a great variety of symptoms may follow, from a fracture as the cause; and the difference of these symptoms will depend on,

The particular nature of the fractured bone.] As for example, the larger bones, such as the os femoris, os humeri, &c. have a cavity in which the medulla is deposited, but the clavicles, ribs, bones of the carpus and tarsus, have no such cavity full of marrow; whence a fracture of the larger bones must be always attended with an injury of the medulla, from whence the very worst consequences may follow.

The different manner in which the fracture is inflicted.] For a transverse fracture is the best, since the parts may be mutually applied to each other; but an oblique fracture is worse, because the extremities of the fractured bone more easily depart the one from the other. Whence Hippocrates [a], in treating of a fracture in the clavicle, observes that it may be more easily cured if fractured quite transversely; but more difficultly, if it is broken in a longitudinal direction. The difficulty of the cure will be also much augmented, if the fracture is accompanied with a violent contusion or wound.

Various condition of the fragments as to their situation, &c.] For when the ends of the bone remain in their proper situation in a transverse fracture, they do not injure the adjacent parts; or when they depart a little to either side, but in such a manner that the lower end as yet sustains the upper, there are no very bad consequences thence following. But when the ends of the bone, being removed from their natural situation, are forced up by the sides of each other, they will necessarily press and injure the ad-

[a] De Articulis Tex. LXXIII. Charter. Tom. XII. pag. 323.

jacent

jacent muſcles, tendons, &c. and a much greater extenſion will be here required to reduce the fractured ends of the bone again to their natural ſituations.

Figure.] For the more acute the fragments, the more will they injure the adjacent parts; whence Celſus [b], in treating of the various kinds of fractures, pronounces, *Omne igitur os, modo rectum, ut lignum in longitudinem finditur: modo frangitur tranſverſum: interdum obliquum: atque id ipſum nonnunquam retuſa habet capita, nonnunquam acuta, quod genus peſſimum eſt: quia neque facile committuntur, quæ nulli retuſo innituntur; & carnem vulnerant, interdum quoque nervum aut muſculum:* "Every bone is therefore fractured, ſometimes in a right line, like a piece of wood that is ſplit longitudinally; ſometimes it is broke in two, tranſverſely, and ſometimes obliquely; ſometimes alſo the extremities of it are obtuſe, and ſometimes acute, which laſt is the worſt kind of fracture; becauſe the ends cannot be reduced together, having no ſupport for each other, and becauſe they wound the fleſh, or ſometimes injure the nerves or muſcles."

Number, magnitute.] The more numerous the fragments into which the fractured bone has been ſeparated, ſo much the more danger is there of injuring the adjacent parts, and the more difficult will it be to retain the reduced bones in their natural ſituation: but the larger the fragments, the cure will be *(cæteris paribus)* ſo much the more eaſy.

According to the different nature of the adjacent parts, or of the part itſelf, &c.] The larger bones are very compact in the middle, but at their articulations their ſubſtance is ſpungy or cellular, formed by the departing of the bony lamellæ from each other: if therefore a bone is fractured near its articulation, it muſt of neceſſity deſtroy this cellular fabric; whence a great number of diſorders may follow from the humours there extravaſated and corrupted. But the li-

[b] Lib. VIII. cap. 7. pag. 524.

gaments which connect the bones to each other, being inserted near their articulations, they will be likewise injured; whence an inflammation of them, and an anchylosis may follow. It was said before in the commentary on § 218. numb. 6. that a very considerable artery enters the tibia, through its upper and back part, frequently running for the length of an inch, in the midst of the substance of the bone itself: if therefore a fracture should happen in that part of the bone where the artery enters, a fatal hæmorrhage may follow, if the fracture is also accompanied with a wound; or else the blood, extravasated under the entire skin, may produce a spurious aneurism, and all the bad consequences that may thence follow.

If again the fractured parts are within the reach of a considerable nerve, artery, or vein, which run near the bone, it is very evident in what danger they are of being compressed or injured by the fragments, especially when they are sharp. Many bad consequences are also to be feared, if the tendons of strong muscles are inserted into the part of the bone fractured. All these circumstances are to be considered at the first dressing, and therefore the surgeon and physician ought not to proceed too hastily, but to consider well the nature of the part fractured, and compare it with those excellent tables of Eustachius; for unless the consequences to be feared are then predicted, they may be afterwards imputed to a mismanagement of those who are employed in the cure; thus, for example, a fracture of the os humeri near its articulation, by compressing or injuring the large nervous trunk there seated, may produce a palsy, a loss of sensation, or a withering, *&c.* of the limb, which can be remedied by no means whatever. Hippocrates [c] also diligently inculcates this admonition, in treating of those fractures where the fragments are forced through the skin; where he says, *Quibus vero femoris vel humeri os excessit, fere non evadunt, sunt enim ossa hæc*

[c] De Fracturis Textu, XLVII. Charter. Tom. XII. pag. 257.

magna,

magna, & multam medullæ habent, & multa ac magna simul lacerantur, nervi, & venæ & musculi. Quod si reponantur, solet nervorum distensio supervenire; si non reponantur, febres acutæ & biliosæ, & singultuosæ, &c. Magis adhuc evadunt, quibus inferior pars ossis, quam quibus superior excessit, &c. Multum quoque differt, si versus interiora os brachii vel femoris excesserit: multæ enim et magnæ venæ per interiorem partem feruntur, quarum nonnullæ vulneratæ hominem jugulant: per exteriorem vero partem pauciores incedunt. In ejusmodi ergo læsionibus non oportet obliviscı periculi, illudque in tempore prædicere: "But those who have a fracture of the os "femoris or os humeri very difficultly escape; for "those bones are very large, contain much marrow, "and at the same time lacerate many and large nerves, "blood-vessels, and muscles. Even if they are reduced, a convulsion usually follows; and if they are not "reduced, acute and bilious fevers, with hiccups, *&c.* "ensue. But those are still more likely to escape, "where the fracture is in the lower part of the bone, "than when it is in the upper part, *&c.* The case "will be also much worse, if the fracture of the os "femoris or os humeri turns inward, because many "and large vessels run by the inner side of the bone, "some of which being wounded kill the patient, but "along the outer side of the bone there are few vessels "placed. In fractures of this kind therefore the danger ought to be remembered, and timely predicted." Thus the worst consequences frequently follow after a fracture of the ribs, when the fragments lacerate the pleura, or even sometimes wound the lungs themselves, whence an empyema, and an incurable consumption, thence following. And a fracture of the calcaneum, into which is inserted the very strong tendon termed Achillis, is often followed with most acute and continual fevers, accompanied with a trembling, hiccup, and dilirium, which destroy the patient in a few days [d].

[d] De Fracturis Textu, XXIII. Charter. Tom. XII. pag. 201.

SECT. CCCXLIII.

THE chief conſequences are therefore a deſtruction of the office of the bone, for ſuſtaining or ſupporting and directing the muſcles; whence a contraction of the muſcles, a diſtortion of them from their proper places with a ſhortening, diſtortion, and deformity of the limb itſelf; a laceration, contuſion, and corruption of the external and internal perioſteum, of the veſſels themſelves ſeated in the ſpungy part of the bone, and alſo of the medulla with its including fine membrane; a luxuriancy of the veſſels of the bone, whence a rough callous tumour, and deformity of the limb; a diſtraction, laceration, irritation, compreſſion, and convulſion of the membranes, tendons, and nerves; an injury, obſtruction, inflammation, and deſtruction of the adjacent veſſels, pain, ecchymoſis, withering, ſuppuration, gangrene, and death itſelf, of the part or of the whole body; but a contuſion almoſt conſtantly attends a fracture.

This aphoriſm enumerates the principal diſorders which uſually follow after fractures of the bones.

A deſtruction of the office of ſupporting.] When we either ſtand or walk the whole weight of our body is ſuſtained by the bones of the thighs and legs; whence it is, that theſe bones, being too flexible in ricketty children, are incurvated by the incumbent weight of the body. When therefore the continuity of the bone is removed by a fracture, this office of ſuſtaining the body is immediately removed, unleſs the fracture ſhould happen to be tranſverſe, ſo that the ends of the bone, as yet retaining their natural places,

places, are sustained the one upon the other; but if in such a case the person walks, or moves the fractured parts, the ends of the bone will soon after be removed from their contact, and be incapable of sustaining the weight of the body. Parey [a] being struck by the kick of a horse, fell down in his endeavouring to avoid farther injury, and both bones of his left leg being fractured, forced themselves not only through the skin, by the pressure which they received from the incumbent weight of the body, but they also perforated the boot itself, with intolerable pain.

Of sustaining and directing the muscles.] Most of the muscles in the body arise from, and are inserted into the bones; so that, if we except the sphincters, and muscular fibres of the vessels and viscera, we shall scarce find any muscle, but what has one end of it fastened to some bone. The bones therefore being fractured, the action and direction of the muscles fastened to those bones will be destroyed, or wonderfully perverted. When the patella is fractured, to which adheres the tendons of the muscles extending the leg, the direction and action of those muscles is then immediately disturbed; because it serves as a support to elevate and sustain their tendons. The same is also true of the other bones.

A contraction of the muscles, and a shortening of the limb.] Galen [b] had in his time observed, that the muscles had in them a natural power of contracting themselves; and that this contraction did not proceed from the faculty of the mind, which moves the muscles; he proves by an experiment, *viz.* That a muscle transversely divided appears to contract itself towards each end, even after death. Vesalius [c] has beautifully confirmed the same thing by experiments made on living animals; for when he totally divided the belly of a muscle, he observed that one part of

[a] Livre XV. Chapitre 23. pag. 344.
[b] De motu muscul. Lib. I. cap. 8. Charter. Tom. V. pag. 376.
[c] Lib. VII. cap. 19. pag. 568.

the muſcle contracted itſelf towards its origin, and the other part towards its inſertion; and upon dividing the tendon of another muſcle, he perceived that the muſcle contracted towards its origin; or if he divided the head of the muſcle, it contracted towards its inſertion. But when he divided the muſcle both at its origin and inſertion, it then contracted towards its belly, and became globular in that part which was moſt fleſhy. But it is the bones, to which the muſcles are attached, which maintain them in this diſtention; ſo that when a bone is broken, the muſcles become ſhorter by a ſpontaneous contraction, and draw up that part of the bone into which they are inſerted; whence the limb becomes ſhorter, in proportion as the muſcles, inſerted into the lower fragment of the bone, are more ſtrong and numerous. Thus if the os humeri is fractured above the place into which the deltoide muſcle is inſerted, it will be then contracted very ſtrongly upwards; whence the arm will become ſhorter: for as Celſus [d] obſerves, *Nam nervi muſculique, intenti per oſſa, contrahuntur:* "The nerves and muſcles, which are kept in a ſtate "of tenſion by the bones, are then contracted." The ſame is alſo true of a fracture in the os femoris. whence it is unanimouſly allowed by the conſent of all ſurgeons, that a fracture in the upper part of the thigh bone, near the hip, is ſeldom curable, without leaving ſome defect in the motion of the limb; but when the ſame bone is fractured in the middle, or towards the knee, there are much greater hopes of obtaining a happy cure. This ſeems to follow, becauſe the higher the fracture of the femur, the greater number of muſcles draw up the lower part of the bone; and as thoſe muſcles are very ſtrong, they require a very forcible extenſion, in order to replace the fragments, which are then alſo very difficultly retained in contact.

[d] Celſus, Lib. VIII. cap. 10. pag. 532.

A diſ-

A disturbance of the muscles from their proper seats.] Most of the muscles arise from and are inserted into the bones, and frequently adhere for a very considerable length to the bones; if therefore a fractured bone should happen to be displaced, it will disturb the situation and course of the adjacent muscles, which arise from or are inserted into the fractured bone; and besides this, the fragments of the bone may disturb other muscles, which neither arise from nor are inserted into the bone fractured; inasmuch as the fragments will expel and displace all the circumjacent soft parts, which cannot be performed without a disturbance of the muscles, whence will follow,

A distortion and deformity of the limb.] The external surface of the human body is beset with various eminences and excavations, which arise principally from the muscles, variously placed, and being either contracted or relaxed, which is more especially obvious in robust men who are not over fat; but in women they are less conspicuous, whose bodies are therefore always more smooth and even. This is very well expressed by the painters and statuaries, when they represent the bodies of Hercules or Laomedon with strong arms, or the body of Venus smooth and uniform. So soon therefore as the muscles are displaced by the fracture of a bone, the figure of the parts is altered, and the natural shape of the limb is destroyed. Hence it is that skilful surgeons compare, for example, the arm or leg which was broken, with the arm or leg of the sound side; and by a strict attention they observe, whether both limbs have the same eminences and excavations, in order to determine whether the fractured bone is properly reduced. For the fragments of a bone, for example, of the humerus, may be adapted to each other, and cohere together, though they are not replaced in the same posture which they had naturally before; but then the deformity of the limb, in this case, will always demonstrate the error. The greatest deformity of this

kind, may follow after a fracture in the bones of the cubitus; for then the ſupinator and pronator muſcles of the hand, commonly alter the natural figure of the parts in a ſurpriſing manner.

We come now to the diſorders which happen to the bones themſelves, after a fracture.

Of the external perioſteum, the veſſels running betwixt the bony cells, the internal perioſteum, the membranes of the medulla, &c.] All the bones are inveſted with a membrane, which conveys veſſels to and from the ſubſtance of each bone, and which is termed the perioſteum, generally adhering very ſtrictly to the bones. This membrane covers the external ſurface of the bones on all ſides, except in thoſe places where the ligaments ariſe from the bones, to inveſt and ſecure the articulations; for in theſe places the perioſteum departs from the bone, and continues to run on over the ligaments, till it is inſerted into and conjoined with the next bone; and in this manner does the perioſteum paſs from one boſne to another, without any interruption of its continuity [c]. The whole ſurface therefore of all the bones is covered with the perioſteum, excepting thoſe parts which are contained in the capſule of each joint, ariſing from the ligaments of each articulation. But it very rarely if ever happens, that the bones are broke within theſe ligamentary capſules, whence a fracture of the bone muſt always injure the external perioſteum. Add to this, that we meet with a very ſurpriſing cellular fabrick in many of the bones; and the ſmaller bones which have no large cavity filled with marrow, ſuch as the bones of the fingers, metacarpus, and carpus, &c. have their whole ſubſtance compoſed of bony cells. But in the larger bones, which have a conſiderable cavity in their middle filled with the medulla; theſe have their bony lamellæ very compact and cloſely united in the middle, but towards the ends of the bone they recede from each other, and form

[c] Clopton Havers Oſteologia nova, pag. 17.

wonder-

wonderful cells, in which the blood veſſels and veſicles of the medulla are depoſited. If therefore one of theſe larger bones is fractured at its extremities, this cellular fabrick will be deſtroyed, the veſſels will be ruptured, and their juices extravaſated; which by corrupting may produce a train of the worſt conſequences. Hence it is eaſily apparent, that a fracture of the bone may alſo deſtroy the internal periofteum with the fine medullary membrane, and the ſubſtance of the medulla itſelf; ſince theſe are ſo tender, that they break to pieces with a rough handling with the fingers, even in an old ox. But what ſevere maladies may follow from a corruption of the medullary oil, we ſhall hereafter declare more at large in the hiſtory of diſeaſes in the bones. But certain it is, that all thoſe parts will be lacerated, if the ends of the fractured bone recede from each other, or ride over the one upon the other; for then all the parts contained within the cavity of the bone muſt be unavoidably lacerated. It is indeed true, that the worſt conſequences, which are to be thence feared, do not always happen after a fracture; but it is evident, that they may ſometimes follow, and therefore it is moſt adviſeable for the ſurgeon to acquaint the patient, or rather his friends, that ſuch accidents may happen; by which means he will prevent them from being aſcribed to any want of ſkill or care in himſelf.

A luxuriancy of the veſſels of the bone, whence an inequality of the callus, with a tumour and deformity of the limb.] In the Prænotiones Coacæ of Hippocrates [h] we meet with the following ſentence, *Quodcunque os in corpore reſectum fuerit, aut cartilago, non augetur*; "Whatever bone or cartilage in the body "is divided, it will not grow or be nouriſhed;" and in the aphoriſms he ſubjoins alſo, *nec coaleſcit*, "that "it will not unite or coaleſce [i]." After him Galen has alſo pronounced, that a bone can never unite

[h] N° 505. Charter. Tom. VIII. pag. 882.
[i] Sect. VI. Aphor. 19. Charter. Tom. IX. pag. 258.

with bone, nor cartilage with cartilage; for in a fractured bone there is an union of the parts by the intervention of a growing callus like glue, but not by a concretion of the divided parts themselves [k]. But in his first commentary which he has writ upon Hippocrates concerning fractures, he has explained this matter more at large [l], where he says, *Quum ossa ob siccitatem naturalem non possint carnis instar coalescere, quasi vinculum quoddam illorum callus fit, circumcrescens fracturæ labiis. Originem vero ei (callo) dat superfluum ipsius ossis fracti nutrimentum. Et quando decumbens non utitur idonea victus ratione, vel etiam plethoricus est, illud superfluum copiosum est, effusumque totas fascias velut effuso sanguine madefacit*; "As the bones "by their natural dryness cannot grow together like "flesh, therefore a callus growing round the margin "of the fracture forms a sort of vinculum or con- "nexion. But the origin of this callus is from the "superfluous nourishment of the bone itself; and "when the patient does not use a proper regimen, or "is of a plethoric habit, that superfluous nourish- "ment is very copiously discharged, so as to wet or "moisten all the dressings or bandages in the manner "of extravasated blood." From hence he seems to think, that the callus does not arise from the proper substance of the bone itself, but that the bone is conjoined by the intervention of a kind of glue, interposed betwixt the fragments; for a little afterwards he subjoins, *Quale enim unitis lignis gluten est, tale ossibus fractis callus*; "For the callus is to fractured bones "the same as glue to pieces of wood united." But since it cannot be denied, that the callus in time acquires the same hardness with the bone itself, and as Galen did not believe a callus to be capable of putting on the nature of bone, it seems surprizing when he expresses himself in the following words: *Quidquid igitur ex eo, dum effunditur, circa fracturæ labia con-*

[k] Galen de Meth. Med. Lib. V. cap. 7. Charter. Tom. X. pag. 113.
[l] Charter. Tom. XII. pag. 179.

crescit,

creſcit, illud, tempore mutatum ab oſſe contiguo, illi ſimillimum fit, & callus nominatur; "Whatever then "concretes about the margin of the fracture, while it tranſudes from thence, the ſame being changed "by time, becomes very much like the bone itſelf, "and is denominated a callus." Whence it appears, that he would have the name of callus continued, even after it has acquired the hardneſs of a bone. After Galen, moſt people ſeem to have been of the ſame opinion. But we have already ſeen in the commentaries on § 158. numb. 9. that the loſt ſubſtance is regenerated in wounds, and the divided parts united, not by the intervention of glue, but by a true regeneration of the loſt fleſh, formed by nature from good blood brought to the parts; as Galen himſelf has truly affirmed in the place there cited. It alſo evidently appears in the hiſtory of wounds in the head, that the part of the ſkull, which is removed by the wounding inſtrument, or cut out by the trepan, grows up again. The ſame therefore ſeems to take place in fractures of the bones, namely, that they conjoin not by the interpoſition of any glue, but by a ſubſtance truly of their own; and in thoſe caſes, where part of the bone is removed, there is not a thick humour interpoſed betwixt the fragments, which gradually hardens, but the organical fabrick of the bone itſelf is reproduced, and repairs the loſt ſubſtance. This truth is very well confirmed by chirurgical obſervations. A man being loaded had the tibia and fibula fractured by a cart-wheel paſſing over his leg, which lacerated all the adjacent parts in ſuch a manner, that nothing leſs than an amputation of the limb could be thought of. But the fragments of the bones being replaced, and proper means uſed, the fibula was perfectly united after two months time; but a conſiderable fragment of the tibia was ſeparated to the length of four fingers breadth, in which the groove of the medullary cavity was conſpicuous; ſo that a large hiatus or ſpace was left betwixt the two

ends of the fractured tibia. But yet this whole ſpace was in ten months time filled with a ſubſtance ſo compact and firm, that the man could afterwards commodiouſly uſe his leg [m]. But does it ſeem credible, that a glue, ariſing from the ſuperfluous nouriſhment of the bone, and tranſuding from its own fractured extremities, could thus elongate the bone exactly without any deviation, ſo as to fill up ſo large a ſpace? Or rather ought not this to be aſcribed to that wonderful property received by the human body from its adorable Creator, by which it is able to reſtore the loſs of ſubſtance, and increaſe the dimenſions of all its parts already formed by changing its aliments into its own nature through the action of the veſſels and viſcera? Certain it is, that the vital rudiments concealed in the facculus of colliquamentum in a fecundated egg, does in the ſpace of one and twenty days build up the whole created fabrick of its little body, and forms ſuch ſolid bones from the ſoft albumen, as not only enables the chick to ſtand, but alſo to run about ſoon after it is hatched. The ſame mechaniſm therefore ſeems to take place in the bones, with reſpect to the reproduction of their loſt ſubſtance, and their concretion after a fracture, as we obſerve to happen in wounds of the ſoft parts; namely, that there is an organical reproduction of the loſt ſubſtance, and a true concretion without any agglutination by the interpoſition of a ſhapeleſs glue.

Now as in wounds of the ſoft parts the repullulating veſſels, which are ſo minute and ſoft, may be too much diſtended for want of the confining ſkin, ſo as to degenerate into a fungous fleſh; the ſame is alſo true with reſpect to the callus of a bone, which may be luxuriant in the ſame manner, if the juices are diſcharged too copiouſly, or if the veſſels are too forcibly diſtended beyond what is neceſſary for reproducing the ſubſtance of the bone, and this is more

[m] Traité complet de Chirurgie, par M. de la Motte, &c. Tom. IV. pag. 284, &c.

eſpecially

eſpecially to be feared in younger ſubjects, whoſe ſolids are always more weak and infirm, and their fluids more redundant, and generally move with a quicker circulation. From hence it is, that ſurgeons have ſo often obſerved a luxuriancy of the callus in young patients, eſpecially after uſing a plentiful diet; but then this accident muſt be neceſſarily attended with an inequality and alteration in the figure of the part. But the deformity of a limb happens ſtill more frequently, when the two ends of the fractured bone are preſſed againſt each other before the callus has acquired ſufficient firmneſs; for then the callus is preſſed out on all ſides like ſoft wax, and forms a protuberant ring round the fractured part of the bone. This accident alſo more eſpecially happens when the patient walks too ſoon upon the fractured bones either of the legs or thighs; for the weight of the body preſſing on the bones forces out the callus, if it has not yet acquired its bony hardneſs.

A diſtraction and laceration of the membranes, tendons, and nerves.] Which more eſpecially follow, when the ends of the bones ride over each other, and ſtill more if the ends of the fragments are ſharp pointed; for then they prick and lacerate all the circumjacent parts. It has been obſerved under the preſent aphoriſm, that when Parey had the misfortune of his leg broken while ſtanding on it, the fragments of the bone not only pierced through the ſkin and muſcles, but even through the boot alſo with intolerable pain. But what dangerous conſequences are to be feared, from the membranes, tendons, and nerves being injured or irritated, has been already ſaid in the commentaries on § 162 to 166, and 181 to 185. Such lamentable conſequences ſometimes follow in theſe caſes, that Hippocrates adviſes the phyſician to avoid them, when he can do it without prejudice; ſince there are here but few hopes and the greateſt danger: [n] *Si enim non reponantur oſſa, medicus videtur*

[n] Hippocrat. de fracturis, Text. L. Charter. Tom. XII. pag. 259.

arte

arte deſtitui, ſi reponantur, homini magis ad interitum, quam ad ſalutem eſt; "For if the bones are not re-"placed, the phyſician will ſeem incapable of his "art; and if they are replaced, the patient will be "advanced nearer to death than recovery."

An alteration and deſtruction of the adjacent veſſels.] The worſt accidents, that uſually follow fractures, ſeldom proceed from the injury of the bone itſelf, but rather from the injury offered to the adjacent ſoft parts, which are compreſſed or wounded by the bony fragments. Great numbers of veſſels then are injured, which are either ſeated in the ſubſtance of the bone or in the adjacent parts, liable to be compreſſed or injured by the diſplaced fragments; whence Hippocrates obſerves, (as we ſaid under the preceding aphoriſm,) that it is of great moment to know, whether the bones of the arms and thighs are diſplaced inwards or outwards, becauſe many and large veſſels run along the inner ſides of thoſe bones. Among the cauſes of obſtruction (§ 112.) we enumerated every thing capable of rendering the flexible canals narrower by an external compreſſure or extenſion; it is therefore evident, that obſtructions muſt frequently follow fractures of the bones. And though the courſe of the humours through the narrow veſſels be not totally intercepted, yet many of the functions of the body may be thence ſurpriſingly diſturbed various ways; ſince the due performance of thoſe functions reſult in a great meaſure from the juſt proportion of amplitude, which the trunks and branches of the veſſels have with reſpect to each other. If now to an obſtruction of the veſſels we add an increaſed circulation of the humours ariſing from a fever, an inflammation will be formed, which may produce all its conſequences, as ſuppuration, gangrene, ſphacelus, *&c.* The ſevere pains alſo in fractures ariſe, not ſo much from the injury of the bone, as from the great diſtention of the membranes, tendons, or nerves; as may in a great meaſure appear from the entire ceſſation or great

great diminution at leaſt of the pains, after the bones have been reduced into their natural ſituations. When veſſels are divided under the entire ſkin, or but ſlightly wounded, the blood eſcapes, and being collected in the panniculus adipoſus, forms an ecchymoſis, as we obſerved in the hiſtory of contuſions. But when the trunk of a large artery or nerve, deſcending to the ſubjacents, is ſo compreſſed or injured that it can no longer tranſmit any thing, the ſubjacent parts are then deprived of all vital influx, and are either corrupted with a gangrene, or are ſlowly dried up or withered; as appears from the remarkable caſe we related of the man, who had the trunk of the axillary artery totally divided, whence his arm remained all his life-time afterwards dried up like a mummy. See the comment on § 161.

But death ſometimes follows fractures of the bones, from the excruciating pains, ſevere fever, delirium, convulſions, &c. or if a gangrene invades the injured part, which turning to a ſphacelus, aſcends to the ſuperior parts, and after reſtleſſneſs, delirium, ſyncope, hiccups, &c. the patient at laſt expires in a pleaſant ſleep.

Almoſt conſtantly a contuſion.] For the external violence cannot diſſolve the continuity of the bone, unleſs it alſo acts upon the ſoft parts incumbent on the bone; and theſe ſoft parts being preſſed betwixt the hard bone and the injuring cauſe, muſt neceſſarily be contuſed. There will be therefore always ſome contuſion in every fracture, unleſs the bones become ſo friable by the venereal diſeaſe, the rickets, ſcurvy, or the like, that they may be fractured by a very ſlight force. But this is a ſymptom that ought always to be well conſidered in fractures, for there are many bad conſequences which ariſe from the contuſion, even after the bone has been happily replaced: whence Hippocrates [o] (enumerating many of the accidents which follow uſually from fractures and luxations)

[o] Textu LXII. Charter. Tom. XII. pag. 268.

lays

lays it down for a general axiom, that more is to be feared from the contuſion, than from the fracture itſelf. For he ſays, *Leviora autem, ut ſummatim dicantur omnia, ſunt vitia, quibus oſſa franguntur, quam quibus oſſa quidem non franguntur, venæ autem & nervi natabiles conteruntur in iiſdem locis. Hæc enim hominem magis ad interitum præcipitant, quam illa, ſi continua febris acceſſerit:* "For the ſymptoms are in ſhort all "of them ſlighter when the bone is broke by the "force, then when it remains whole, for the conſi-"derable veſſels and nerves are cruſhed in thoſe "places, where the injury is received: and this con-"tuſion accompanied with a continual fever, hurries "the patient to his end ſooner than a fracture." Therefore thoſe remedies are often neceſſary to be uſed in fractures which are proper in the cure of contuſions. For though the juſt replacing of the fragments, and the retention of them in their proper places, ſeems to ſatisfy the firſt or general intention, and may appear of themſelves ſufficient in the judgment of many ſurgeons, yet it is very apparent from what we have before ſaid, that a different method of treatment will be required according to the various accidents which accompany the fracture.

SECT. CCCXLIV.

FROM a conſideration of all which (342, 343.) we are informed of the exiſtence and nature of a compound fracture: to which if we add, the examination of the fragments by the touch; their crackling or grating againſt each other, ſenſible to the ear; the deformity and immobility of the limb, evident to the eye; with a knowledge of the cauſe, its degree of violence, and the manner of its acting, or whether it was aſſiſted by the winter's cold, a decrepid old age, or

or a morbid temperature; from conſidering all theſe at the ſame time, the diagnoſis of the fracture will be ſtill more evident.

This aphoriſm deſcribes thoſe ſigns, by which a preſent fracture may be diſcovered. For there are ſometimes accidents of this nature, in diſcovering which the moſt ſkilful ſurgeon may find much difficulty. Moſt places are furniſhed with a ſet of people who call themſelves bone-ſetters; who though they are for the moſt part very ignorant, endeavour to perſuade the common people, that they underſtand the art of reſtoring fractured or diſlocated limbs, even better than the ſurgeons themſelves. Theſe generally lay the fault of almoſt all diſorders of the limbs either to fractures or luxations, and have immediate recourſe to the application of the whole apparatus uſual in thoſe accidents; by which means they often defraud the patient, and hinder him from his buſineſs without any real neceſſity. By theſe impoſitions they conceal their ignorance, and make thoſe who are unſkilled in theſe matters believe they have performed wonders. But it is the buſineſs of a prudent and honeſt perſon, to uſe his utmoſt endeavours to know whether there is any real fracture or not. The diagnoſis of a fracture is indeed eaſy, when the fragments of the bone are removed from their places, and run up by the ſides of each other, or even force themſelves through the ſkin; but when the fragments remain contiguous, or are ſo little diſplaced, that they ſuſtain each other, and the fractured bone itſelf is covered on all ſides with ſtrong muſcles, as in the thigh; the fracture in that caſe is much more difficult to diſcover. The ſame difficulty is alſo frequently obſerved in diſcovering a fracture in the cubitus or leg, when only one of the two bones, ſeated in thoſe limbs, happens to be broken; as alſo when the ſurgeon is called later than he ought to have been,

and

arm, the os humeri broke tranſverſely about four or five fingers breadth below the ſhoulder. Upon removing the dreſſings three days after the bone had been ſet, the phyſician and ſurgeon, who began to be pleaſed with the ſeeming ſucceſs, upon a narrow inſpection found another fracture of the ſame bone, near the elbow, and this they alſo immediately dreſſed with a ſuitable apparatus. But in another epiſtle writ from the ſame phyſician to Hildanus, about ſix months after the accident, there is an account that they had in vain waited two whole months in expectation of a callus to be formed for uniting the bone; and that the man dying afterwards of an inveterate ulcer in his kidneys, they found the os humeri wholly corrupted with a caries. Another caſe of the like nature is alſo related by the ſame author[c]; *viz.* of an honeſt woman near ſixty years old, who had her os humeri fractured in bed, without any external violence, while ſhe was endeavouring to raiſe her body, and put on a clean ſhift. This fracture was afterwards cured by proper aſſiſtance; but when ſhe was about to get up after ſo long a confinement to her bed, the maid aſſiſting to put on her ſtockings, unfortunately broke her right leg tranſverſely. The ſurgeon being called, made a cure likewiſe of this fracture in the uſual manner, without much difficulty. In this manner ſhe ſurvived, ſuffering various fractures, for the ſpace of two years, at the end of which time ſhe expired with excruciating pains. There ſeems to have been nothing of the venereal diſeaſe in this caſe, becauſe the huſband never found himſelf diſordered; and they had ten children in perfect health; nor was there ever any occaſion in the leaſt to ſuſpect the mother's honeſty. Hence it is evident, that a friability of the bones may ſometimes ariſe from latent cauſes, whence they are often fractured by a very ſlight force.

[c] Centur. 2. Obſerv. 68. pag. 141.

SECT.

SECT. CCCXLV.

BUT it is more difficult to discover an oblong fracture, till after some delay; yet the pain, tumour, thickness, and inequality of the part, with the discharge of a foul matter, and the known violence of the cause, will afford some light towards the discovery.

A fracture is said to be oblong, when a bone is split according to its length by some external violence, like a slit in a piece of wood. Such a fracture is very difficultly discovered, unless it should happen in a part where it lies almost naked to the touch, as in the anterior part of the leg, where the os tibiæ lies sufficiently exposed throughout its whole length, to be examined by the fingers; but in other parts of the body, a person cannot easily distinguish a longitudinal fracture. In reality, the worst consequences may follow such a fracture; which consequences then denote too late that such a fracture is present. For in a bone thus split, the vessels running through its substance are broke, and their juices extravasated, whence they putrefy and induce a caries of the bone; or they may also inflame and suppurate the parts incumbent on the bone. The principal signs of such a fracture, if a cause sufficiently violent is known to have preceded, are, the attendance of a deep and lasting pain, with a tumour or elevation of the parts incumbent on the bone, and extending itself according to the length of the bone. If after this the integuments break and discharge a foul matter, there will be still greater reason to suspect that the subjacent bone is injured. But even all these signs are doubtful enough, since they frequently follow a violent contusion, though unaccompanied with any such fracture: it is true, the discharge of a foul

manner denotes too late that the bone is corrupted; whence the timely diagnosis of this kind of fracture is very difficult. But even the discovery of such a fracture to be present, would not conduce much to the benefit of the patient; for what can art perform, in such a case, when all the parts retain their situations, and only the bone is injured? Some body will perhaps answer, that phlebotomy, with discutients, antiphlogistic fomentations, a thin diet, *etc.* are to be used, to prevent an inflammation, suppuration, and all their consequences. But the contusion, which always accompanies this sort of fracture, will require those means, even though the bone be not injured. In the history of wounds in the head, we directed how a fissure of the skull ought to be treated; but then can other bones split longitudinally in that manner be safely denudated, so as to be either scraped away by the rasp, or bored through with many small foramina? If the thigh bone is known to be thus fractured, who will dare to cut through the strong muscles which invest it, in order to make a way for his hand to the affected bone? This method of cure can be therefore performed in but a few parts of the body, where the bones are only covered with the common integuments; but then in those places it is also much more easy to discover this injury. In the other parts of the body, therefore the knowledge of such a kind of fracture must be very difficult to obtain, and of no great use if known; since no other means can be used, besides the general remedies proper for all contusions.

SECT. CCCXLVI.

THAT the cure will be either easy or difficult, quick or slow, compleat or defective, may be predicted from the figure, simplicity, or complication, and age of the fracture; as also from

from the number, figure, and magnitude of the fragments; the particular place of the bone fractured, the adjacent parts injured, with the ſeaſon of the year, and the age and habit of the patient.

This aphoriſm treats concerning the prognoſis of fractures, which indicates the bad conſequences to be feared, or the good events to be hoped for. Therefore all the effects of fractures, enumerated in § 343, are to be here conſidered, and after a ſtrict examination, we may then conclude (from the known nature of the fracture, with an anatomical knowledge of the parts) whether the cure will be eaſy or difficult: but the cure is ſaid to be eaſy, when it can be performed without any great endeavours of art, and without much trouble to the patient; and it is ſaid to be difficult, when the contrary obtains. In the next place, it ought to be determined whether a long or a ſhort ſpace of time will be neceſſary to reſtore the bone to its due firmneſs and continuity. And laſtly, it muſt be enquired whether the cure may be expected to ſucceed ſo well, that the broken limb will recover the ſtrength, form, and action which it had before; or whether any ſenſible defect will remain after the cure, ſo as either to disfigure the injured limb, or elſe impede or deſtroy its action. But in doing this great prudence is neceſſary; for generally the remaining defects are imputed to the fault of the ſurgeon, to his great prejudice, if he does not foretel them. For though an honeſt ſurgeon ought not, like a pretending quack, to magnify a ſmall injury, that he may be thought to have done great matters; yet prudence requires of him to mention the bad conſequences to be feared, leſt he ſhould be thought ignorant or incapable in his art. If a ſurgeon who is too fearful, makes a bad preſage in a ſlight caſe, frequently another is called to undertake the cure; and

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if he ſucceeds, it injures the character of the former. Nor will it be leſs prejudicial to promiſe a happy cure, and the event proves bad. But to form a ſafe prognoſis, attention muſt be given to the following particulars.

Figure of the fracture.] That kind of fracture is of all the beſt, which is termed tranſverſe or raphanoide; eſpecially if the fragments as yet ſuſtain each other, and are not quite diſplaced. But the cure of an oblique fracture is much more difficult; becauſe in that the fragments do not mutually ſuſtain each other, and they are very eaſily diſplaced or removed from their contacts by the contraction of the muſcles faſtened to the bones, nor is it eaſy to ſecure the parts ſo by bandage, that the fragments ſhall continue in their proper places after they have been reduced. Celſus [a], treating on fractures, has very well expreſſed this; for he ſays: *Earum maxime tolerabilis eſt ſimplex, eaque tranſverſa: pejor, ubi obliqua, atque ubi fragmenta: peſſima, ubi eadem acuta ſunt:* "Of "theſe fractures, the moſt tolerable is the ſimple and "tranſverſe; but it is worſe when the fracture is ob-"lique, and when there are fragments; and the worſt "of all, when thoſe fragments are ſharp pointed."

Simplicity or complication.] It is very apparent, that the cure muſt be much more difficult when the bone is fractured in ſeveral places; and the more ſo, if the fractured places are ſo diſtant from each other, that they cannot be inveſted by one and the ſame apparatus, but each fracture muſt have its particular dreſſings. A remarkable caſe of this nature is given us by Le Motte [b], of a man who broke his leg both towards the ancles and the knee: after both fractures had been dreſſed with a convenient apparatus, the uppermoſt continued well enough, but the lower fracture had ſuch ſevere pains, as made it neceſſary to treat it afterwards with the foliated bandage, in the

[a] Lib. VIII. cap. 10. pag. 530.
[b] Traité complet de Chirurgie, Tom. IV. pag. 254, &c.

manner

manner of a compound fracture. But if the fracture is complicated, as well as compound, that is, if it be accompanied with a wound, contuſion, inflammation, *etc.* you will foreſee the cure to be ſtill more difficult.

Age of the fracture.] When the parts of the fractured bone continue in their natural ſituations, there is no great danger to be feared from the long continuance of the fracture; becauſe art can do nothing more in that caſe, than prevent the fragments being diſplaced, by the application of a ſuitable apparatus. But where the fragments no longer ſuſtain each other, but ride over or ſlip up by the ſides of each other, then the diſtraction and laceration of the parts is the greater, in proportion as a longer time has elapſed ſince the fracture; whence enormous pains, inflammation, tumour, *etc.* uſually follow; and in that caſe it is impoſſible to reduce the fracture before thoſe ſymptoms are removed, or in ſome degree mitigated. For if a part thus violently inflamed and ſwelled was to be roughly handled, it would ſoon be invaded with a gangrene; or from the great ſeverity of the pain, convulſions might follow. But when the bone is expoſed naked in a compound fracture, or if a fragment of the bone ſtarts through the ſkin, in that caſe the cure may be reaſonably expected to ſucceed more ſlowly and difficultly, as the parts have been longer expoſed to the air; becauſe here it is often neceſſary to wait for an exfoliation of the diſeaſed part of the bone; as is evident from what has been ſaid on this ſubject, in the hiſtory of wounds of the head, § 249, 250.

The number, figure, and magnitude of the fragments.] The more numerous the fragments, the more difficult will it be to retain them in their proper ſituations, after they have been reduced; which will be alſo the more difficult, as the fragments are leſs: as for example, if the os humeri is fractured in two places, ſo that a piece of its middle is ſeparated, to the length of three fingers breadth; ſuch a fracture,

though ever so well reduced, would be very difficultly retained in its proper situation, since the contraction of the muscles, and the pressure of the splints and bandages, would be very apt to displace the fragments. Such a fracture would therefore require a machine capable of retaining the limb in its due extension; and as such fractures require the most formidable assistances of art, they cannot be termed easy to cure. In such like fractures, Hippocrates [c] recommends the use of two cylinders, or round plates of Turkey leather, like what is used by those who are a long time confined in heavy fetters; and in a fracture of the leg, he directs to apply one of them above the ancles, and the other below the knee. These plates are to be furnished with loops on each side, of single or double leather; in such a manner that the loops of the upper plate may correspond to those of the lower: he then introduced splints of horn of a due length into those loops, which held the leathern plates extended to their due distances. Thus did Hippocrates maintain the limb at its due length, and preserve the fragments from being displaced at the same time; and in the same place he describes at large, what more is necessary to be observed in the application of the plates. But when the fragments are sharp pointed, the case is very difficult to cure; because the fragments greatly injure the adjacent parts, and are difficultly retained as well as reduced, as we said before in the comment on § 342. It also appears from chirurgical observations, that the division of a bone made by a sharp or cutting instrument, cannot be cured in so short a space of time, as a fracture by a blow with an obtuse instrument; which seems indeed wonderful. But the reason may perhaps be this, that a common fracture has always some eminencies or asperities, which retain the bones more firmly together, after they have been rightly reduced, so that they can the better unite, and the fragments

[c] De Fracturis Textu, 29. Charter. Tom. XII. pag. 246.

are

are not so liable to be moved or rubbed against each other in coughing, sneezing, or the like motions; which attrition must destroy the repullulating callus, or at least retard the union of the fractured bone. But when a bone has been divided by a cutting instrument, the surface of the fragments is smoother, and they are more liable to be moved or rubbed against each other. There are three or four remarkable cases, in confirmation of this, to be found in the observations of the deserving Le Motte [d], who affirms, that an incised fracture, even a simple one, takes double the time in the cure, which a common or even a bad complicated fracture requires, except those which have a considerable loss of substance or a violent contusion of the bone into small splinters.

The part of the bone injured.] It was said in the commentary on § 342. that fractures have various consequences, according to the different part of the bone that is injured. Celsus [e] enumerating some of the effects common to fractures of the arms, thighs, legs, and fingers, says, *Siquidem ea minime periculose media franguntur: at, quo proprior fractura capiti vel superiori, vel inferiori est, eo pejor est. Nam et majores dolores adfert, et difficilius curatur*: "That they "are indeed broke with the least danger in the mid-"dle; but the nearer the fracture is to the upper or "lower head of the bone, it is so much the worse; "for it then occasions greater pains, and is more dif-"ficultly cured." For the larger bones are the hardest in their middle; but in their extremities, which are articulated to the next adjacent bones, they are cellular and friable. The difficulty is also still augmented by the adjacent ligaments of the articulations which connect the bones. There is also much difference betwixt a fracture in the upper or in the lower end of the bone, as we demonstrated from the testimony of Hippocrates in the commentary on § 342.

[d] Traité complet de Chirurgie, Tom. IV. pag. 303—318.
[e] Lib. VIII. cap. 10. pag. 530.

Thus Hildanus [f] has obſerved, that if the os femoris is fractured near its articulation with the hip, the fracture can hardly ever be cured without a halting of the limb remaining; but that when the ſame bone is fractured in the middle or towards the knee, it may be often cured by an expert ſurgeon without any defect remaining. And in the ſame place he confirms his aſſertion by the teſtimony of many conſiderable authors.

The adjacent parts injured.] Concerning theſe, ſee what has been ſaid in the commentaries on § 342.

Time or ſeaſon of the year.] Hippocrates [g] has pronounced warmth to be very friendly to fractured bones, eſpecially if they are naked; but cold, he ſays, is an enemy to the bones [h]: and therefore the cure of a fracture will *(cæteris paribus)* ſucceed leſs proſperouſly in winter than in ſummer. But in the ſummer heats there is greater danger of a putrefaction; and therefore a cure may be expected to ſucceed the moſt happily in ſpring and autumn.

Age of the patient.] The nearer a perſon is to the birth, the more ſpeedily does a fractured bone unite; and in extreme old age a fracture either not at all unites, or at beſt but very ſlowly: but in younger ſubjects there is more danger of a luxuriancy of the callus; which makes a middle age ſeem to be the beſt. The eminent ſurgeon Le Motte [i] ingenuouſly confeſſes, that he had twice met with the misfortune of breaking an arm in extracting the fœtus by its legs in difficult births; but then they were eaſily cured by a ſlight apparatus in twelve days time, whereas in adults, who are in health, a fracture requires at leaſt thrice that time to be conſolidated.

Habit or temperature.] All thoſe diſorders, which either conſume or corrupt the fat of the body, occa-

[f] Centur. V. Obſerv. Chirurg. Obſerv. 86. pag. 475, 476.
[g] Aphor. 22. Sect. V. Charter. Tom. IX. pag. 207.
[h] Ibid. Aphor. 18. pag. 204.
[i] Traité complet de Chirurgie, Tom. IV. pag. 171.

ſion

sion fractured bones either not to unite at all, or at least but very slowly; and therefore fractures are hardly curable in the worst stages of the venereal and scorbutic diseases, and in the rickets, consumptions, *etc.* as appears from the instances which we mentioned in the commentary on § 344. But there is perhaps such a latent dispositon in the habits of some people, which prevents the bones from easily uniting, even though no remarkable cacochymy or other visible disorder attends. The celebrated Ruysch [k] asserts, he has met with such a case, where the bones would not unite, even though all the proper rules of art were observed towards obtaining a cure. And in his observations anatomical and chirurgical [l] he relates, that in the body of a man, who was hanged in full health, he found two of the anterior bones of the carpus not yet conjoined, even though they were fractured three years before. I have myself seen a woman, who having broke her arm, it was afterwards reduced according to art, but it never united, even though she was in the flower of her age; whence her arm remained flexible in the part where it had been broken during her whole life-time afterwards, which was yet no great inconvenience to her. It is an observation made by Hildanus [m], that the consolidation of fractured bones succeeds very difficultly in women with child; and he relates the case of a fracture in the middle of the tibia in a woman, who had passed the seventh month of her pregnancy, but the fragments were not united, though three and twenty weeks were elapsed since the fracture; but at length in the thirtieth week the cure was compleated. But in this woman the fracture was attended with a considerable wound, and some fragments of the bone came away; whence it may be perhaps judged, that these accidents rendered the cure so slow and difficult. But he has in another place [n] gi-

[k] Adverf. Anatom. Decad. 2. n° 2. pag. 6.
[l] Obfervat. IV. pag. 8. [m] Centur. V. Obferv. 87. pag. 484.
[n] Centur. VI. Obferv. 68. pag. 582.

ven

ven a very remarkable hiſtory, which confirms the difficulty of curing fractures in women with child. A woman of quality, of a corpulent and plethoric habit, endeavouring to mount a horſe, broke her left tibia betwixt the knee and the ankle: the fracture was happily reduced the ſame day by Hildanus, who neglected nothing that might forward a ſucceſsful cure; and as no pain, nor any other bad ſymptom appeared, he hoped that the cure might have been compleated within the ſpace of two months. When the fortieth day came, the callus was found ſoft and ſlippery; but as the patient had hitherto ſuckled an infant, ſhe was ordered to wean it; in a little time after ſhe appeared to be with child, and was happily delivered of an healthy and ſtrong girl ſeven months after the fracture was received. The fractured bones could not be united, during the whole time of pregnancy, by all the means that were tried; even though the lady's impatience and continual complaints of the ſlowneſs of the cure excited Hildanus to uſe the utmoſt diligence and induſtry. Yet within thirty days after her delivery the callus became firm, and the limb recovered its former uſe and ſoundneſs. Hence he concludes, that nature being fully employed in forming and perfecting the fœtus, in a manner neglected to form a callus. Obſervations of the like nature, in confirmation of this, may be ſeen in the *miſcellanea curioſa* [*]. But we are in the ſame place furniſhed with the hiſtory of a woman, who having broke her left knee-pan in the fifth month of her pregnancy, was nevertheleſs ſo well cured in the ſpace of ſix weeks, that ſhe could walk about the houſe with ſome difficulty. Hence, therefore, though it does not ſeem to be an univerſal concluſion that fractures of the bones in women with child will not unite before the birth; yet it ſeems adviſeable in theſe caſes to mention the difficulty beforehand, leſt the ſlowneſs of the cure ſhould be af-

[*] Decur. 1. A. 1. Obſerv. 25. pag. 91.

terwards

terwards imputed to ſome fault in the ſurgeon or phyſician.

SECT. CCCXLVII.

THE cure of a fracture requires, 1. A reſtitution of the parts into their natural ſituations by extenſion and reduction. 2. A retention of them in that poſition by bandages and machines or inſtruments. 3. A conſolidation of the united and retained fragments by the growing up of a callus.

We have here the general method of cure common to all fractures. But every cure is the producing of ſuch a change in the parts of the living body, as will remove the corporeal effect, termed the diſeaſe, (ſee the comment on § 4.) and likewiſe reſtore that, whoſe abſence produced the diſeaſe. Now in a fracture there is always a removal of the continuity of the bone, and generally a change in the natural ſituation of its parts; whence it evidently follows, that the cure will require firſt a reſtitution of the divided parts to their natural ſituations, and then a conſolidation or union of them; both which may be obtained by the means deſcribed in the three numbers of this aphoriſm.

1. When the ſituation of the parts has been altered, an extenſion is always required before the fragments of the bones can be ſafely reduced. For the ſurfaces of the fragments are generally rough and unequal; whence, if the reduction was to be attempted without an extenſion, the fragments would grate againſt each other, and break off ſome ſplinters or aſperities, which interpoſing betwixt the fragments, would either retard their conſolidation, or being thruſt out into the adjacent ſoft parts, they would irritate and injure the membranes, tendons, *etc.* as Fabricius Aqua-

Aqua pendente has very well obſerved [a]. Add to this, that the muſcles contract themſelves (as we mentioned in the comment on § 343.) ſo ſoon as the coheſion of the bone is removed, which directs and ſuſtains them; whence an extenſion of them appears to be neceſſary before the fragments can be replaced.

2. After the bones have been reduced to their natural ſituations, that alone would ſuffice, if the part could be retained without motion by the influence of the will; but as there are frequently very conſiderable commotions produced in the body, either without the patient's knowledge, as in ſleep; or without his inclination, as in ſneezing, coughing, laughing, *etc.* by which means the replaced bones might eaſily be diſturbed from their ſituations; for this reaſon therefore, bandages, compreſſes, ſplints, and other machines are required, according to the nature of the part injured, to retain the limb firm and immoveable. It is frequent with many patients, for the firſt two or three nights after the fracture is reduced, to pull up the affected limb ſuddenly in their ſleep, in a manner as if it was convulſed; whence they uſually awake in a fright: now if in ſuch a caſe the limb was not properly ſecured, the reduced fragments would be removed, and require to be replaced again. This is what Parey [b] laments to have happened to himſelf, that while he was ſleeping in the night-time, his broken leg ſo forcibly ſtarted up of a ſudden, that the fragments were diſplaced; whence a new extenſion and reduction was neceſſary; and which were performed with much greater pain than at the firſt time.

3. It was demonſtrated in the commentaries on § 343. that the fragments united and grew to each other, not by the interpoſition of a glue, which by its coheſion faſtened the ends of the bone together, but by a true union of their ſubſtance, in the ſame manner as in wounds of the ſoft parts, there is a union

[a] Oper. Chirurg. Lib. IV. de fracturis, cap. 3. pag. 328.
[b] Livre XV. Chapit. 25. pag. 346.

of

of the divided parts and a reproduction of the loſt ſubſtance. From whence it is very apparent, that art can do nothing in this reſpect, but that the nature and fabrick of the human body only performs the whole, while healthy juices are diſtributed in a due quantity, and with a proper force through their reſpective veſſels to the parts injured. All therefore, which has been ſaid concerning the regimen and diet proper for the cure of wounds in general, is here applicable. And hence it is, that fractured bones are obſerved to unite ſo ſoon in infants; and ſo very ſlowly or not at all in thoſe of a decrepid old age: becauſe the younger the patient, or the nearer to its birth, the faſter it is obſerved to grow or increaſe. Hence Hippocrates [c] juſtly pronounces, *Aluntur quædam ad incrementum, et ad eſſentiam; quædam ad eſſentiam ſolam, ut ſenes: quædam præterea et ad robur:* "Some are nouriſhed "ſo as to increaſe their body, as well as preſerve it; "and others only ſo as to preſerve it, as in old peo- "ple: ſome again are ſo nouriſhed as to acquire "ſtrength alſo." From hence it is ſufficiently evident, that viſcid aliments conduce nothing to the formation of a callus, ſuch as the decoctions of the ſeveral ſorts of corn, and the jellies of animal ſubſtances, which are recommended by *Fabricius ab Aquapendente* [d]: but that theſe will be rather prejudicial, as they are ſo difficult to digeſt, eſpecially in quieſcent bodies, where they occaſion a ſpontaneous glutinoſity, firſt in the *primæ viæ*, and then in the blood, as we demonſtrated in the commentary on § 69. Hildanus [e] tells us he obſerved a man of forty years old of a good habit to fall into a cachexy by ſuch a viſcid diet, which was preſcribed to him by an empiric; whence he was afterwards troubled with a jaundice, accompanied with other bad ſymptoms, and at length he periſhed of a dropſy. Nor can we expect the uſe

[c] De Alimento Text. 45. Charter. Tom. VI. pag. 293.
[d] Opera Chirurg. Lib. IV. de fracturis, cap. 6. pag. 335.
[e] Centur. 1. Obſerv. Chirurg. Obſerv. 92. pag. 71.

of

of the ſo much praiſed lapis oſteocolla to conduce any thing more to the formation of a callus, becauſe its hollowneſs and ſimilitude (having a cavity like that in which the medulla is depoſited in the middle of the bones) has made ſome people imagine it a ſpecific medicine for the bones; which it alſo reſembles in its ſpongy texture and friability. It is indeed evident, that this earthy and unactive medicine may be ſafely adminiſtered; but that it has any ſuch efficacy towards the production of a callus, hath not yet appeared. Hildanus [f] indeed extols the virtues of it, and aſcribes to it his happy ſucceſs in the cure of a fracture of both bones of the leg in a man of forty years old of a bad habit; and he alſo aſcribes the too great luxuriancy of a callus to the imprudent uſe of this ſtone in a healthy lad of fourteen years old of a ſanguine habit. But we very well know, that even very bad fractures are happily cured in adults without the uſe of this ſtone; and we alſo know that the callus abounds in younger patients. But though Hildanus aſcribes his happy ſucceſs as above ſolely to the uſe of this ſtone, yet we find that he had recourſe to other more efficacious helps, when he found nature languiſhing in the body of an old patient [g]. Namely a decrepid old man of ſeventy received a compleat fracture of the bones about the carpus by a blow with a ſtick; and many years before he had been troubled with a palſy of the ſame ſide, which was not yet entirely removed. After replacing the fragments, Hildanus being obliged to undertake a long journey, left the reſt of the treatment to his ſervants; but returning again after a month, upon examining the part fractured, he found by the grating of the bones that they were not yet united by a callus. After ordering a very rich and nouriſhing, but not a viſcid, diet, he gave the lapis oſteocolla night and morning with cinnamon; he afterwards daily anointed the arm with a

[f] Obſerv. Chirurg. Centur. 1. Obſerv. 90 & 91.
[g] Ibidem, Centur, 3. Obſerv. 90. pag. 275.

ſtimulating

ſtimulating aromatic unguent, and then applied an emplaiſter of the ſame kind, with which ſome lapis oſteocolla was intermixed; and by theſe means in a few days time there was no grating of the bones to be heard, but the cure was compleated in the ſpace of four weeks. Hildanus would willingly aſcribe the ſucceſs of the cure to the lapis oſteocolla: but in reality the rich diet excited the languiſhing powers, the ſtimulating ointment and aromatic plaiſter procured the juices to flow more effectually and powerfully into the affected parts, and by theſe means conſpiring the cure was compleated. How much may be done towards reſtoring a defective nutrition in any part of the body, by ſuch a ſlight or gentle irritation, has been already obſerved in the commentary on § 35. numb. 3. But when by weakneſs, or from the ill condition of the fracture, thoſe powers are abſent, which unite the divided parts, and regenerate the loſt ſubſtance of the human body, in vain is the lapis oſteocolla adminiſtered, as is evident even from the teſtimony of Hildanus [g] himſelf. For he candidly confeſſes, that he adminiſtered this ſtone, and applied it externally without ſucceſs in a woman with child; and that after her delivery the cure happily ſucceeded. From hence I believe it is ſufficiently apparent, that ſuch remedies may be uſed without harm; but that the regeneration of the loſt ſubſtance, and the reunion of the divided parts, as well in the bones as in the ſoft parts, is to be expected from the nature of the human body only, which is of itſelf ſufficient.

SECT. CCCXLVIII.

IF the fragments retain their proper ſituations, the firſt indication then ceaſes.

If they have receded but a little to either ſide, only a ſmall extenſion is then required.

[g] Obſerv. Chirurg. Centur. 5. Obſervat. 87. pag. 484.

But

But if the fragments are ſo diſplaced that they run up by the ſides of each other, a large extenſion is then required in order to remove the intercepted parts, make a ſuitable reduction, and reſtore the whole to its due length.

Retain their ſituations, *etc.*] It ſometimes happens, eſpecially in the winter-time, when all bodies are more rigid and brittle, that a bone is ſo fractured by a fall or other accident, that the fragments remain in their natural ſituations; and ſuch a fracture is known chiefly from the preceding cauſe being ſufficiently violent, the pain deep, and a grating or crackling of the bones ſenſible to the ear or hand, when each part of the limb is agitated by the two hands. If then no alteration can be obſerved in the figure of the part, upon comparing it with the like part that is ſound, (though the ſituation of the parts may be changed by turning them round, while the fragments remain contiguous) it is very evident that no extenſion nor reduction is then required, only the fragments are to be retained in that ſituation in order to a cure.

If they recede but a little, *etc.*] A bone is often broke ſo, that the fragments ſupport each other, and yet form a protuberance on each ſide, or though the fragments remain in contact with each other on all ſides, yet the bones may be ſo twiſted, or drawn ſideways, as to change the ſituation and direction of the parts inſerted into the bones, which will appear from the deformity or injured figure of the limb. No violent extenſion is required in theſe caſes, only ſuch will be ſufficient, as is capable of ſetting the bones at liberty from touching each other, that they may be reduced to their proper places without any grating of the fragments or ends of the bones.

By the ſides of each other, *etc.*] For then the limb is contracted in its length in proportion as the fragments ride more or leſs over each other; and therefore

therefore such an extension is here required before the reduction can be made, as will draw the parts a little beyond their natural length, that the fragments may be replaced without rubbing against each other, and without intercepting any of the adjacent parts. Whence Celsus [a] observes, after describing the signs by which such a fracture may be known; *Ergo, si hoc deprensum est, protinus id membrum oportet extendere. Nam nervi musculique, intenti per ossa, contrahuntur: neque in suum locum veniunt, nisi illos per vim aliquis intendit*; "Therefore when this sort of fracture "is discovered, the limb must be immediately extend-"ed: for the nerves and muscles, which are kept "extended by the bones, are then contracted; nor "will they recover their situation, unless they are ex-"tended by some force." And afterwards he adds, *Ubi vero paulo longius, quam naturaliter esse solet, membrum vis fecit, tunc demum ossa manibus in suam sedem compellenda sunt, etc.* "But when the extending force "has made the limb a little longer than it naturally "used to be, then it is that the bones must be pres-"sed into their proper places by the hands," *etc.* Nor is it easy to make too great an extension, especially in fractures of the larger bones; and therefore Hippocrates [b], in treating of a fracture of the thigh bone, orders a strong extension to be made; and adds, that the limb will not be injured, though the extension be made larger than necessary. And in another place he observes [c], that most make their extension less than they ought; but that he had seen too violent an extension made on a child. For in the younger age all the parts are softer, and a violent extension may there force the parts a good deal beyond their natural length, which is not much to be feared in adults, especially in fractures of the larger bones; for the strong muscles and tendons in them sufficiently guard

[a] A. Corn. Celsi Medicin. Lib. VIII. cap. 10. pag. 532.
[b] De fracturis, Textu 68. Charter. Tom. XII. pag. 222.
[c] Textu 19. ibid. pag. 167.

againſt too great a diſtraction of the parts. Add to this, that a ſkilful ſurgeon may diſcover when the extenſion is made ſufficiently, or whether it is required to be ſtronger, by feeling the fractured parts with his hands. In fractures of this kind therefore all ſurgeons order a forcible extenſion; and Parey [d] ſtrongly invited the ſurgeon not to ſpare him when his broken leg was to be ſet; deſiring of him at that time to forget that he was curing a friend. But how violent an extenſion is ſometimes required in difficult caſes, may appear from the following hiſtory. A young man broke the tibia and fibula of his right leg near the ankle in ſuch a manner, that the bones forced their extremities for near two inches through the integuments: and in this condition the unfortunate patient lay for ſeven hours before the ſurgeons could attend, whence the limb was by that time very much ſhortened, and a conſiderable tumour formed in the circumjacent parts. This fracture was alſo attended with a conſiderable wound, and the celebrated ſurgeon chiefly concerned owns, that the extenſion was made ſo forcibly in order to replace the fragments, that his aſſiſting ſurgeon often cautioned him not to let the foot be pulled off [e]. But in what manner the extenſion of a broken limb may be conveniently made, and with what precautions, is taught in the following aphoriſm.

SECT. CCCXLIX.

THE extenſion is performed, 1. by taking firm hold of the bone near the fracture, either with the hands or with ſlings; 2. by firmly ſecuring the patient; 3. by placing the part in its natural poſture; 4. by a ſlow diſtraction of the

[d] Livre XV. Chapit. 23. pag. 314.

[e] De la Motte Traité complet de Chirurgie, Tom. IV. pag. 293, &c.

fractured

fractured parts from each other, in a right line, with such a force as is sufficient to overcome the contractile power of the muscles; 5. or lastly, by the power and application of mechanical instruments, if the strength of the hands fail.

1. If nothing forbids, the injured limb is to be taken hold of by the hands near the place of the fracture; but sometimes a wound, violent contusion, or a distortion of the muscles, surprisingly altering the figure of the part, forbid the application of any force to the circumjacent parts of the fracture. But since the surgeon, who reduces the fragments, cannot at the same time make the extension of the limb himself, except in the lesser bones, as of the fingers, *&c.* it is therefore necessary to have assistants, who may make the extension at the same time that he replaces the fragments into their proper situations. Therefore the most skilful surgeons, especially in the more dangerous cases, call in the assistance of other surgeons, who, understanding the method of extension, know how to perform it as equally as possible, which conduces a great deal towards a happy restitution of the fragments. But as the part is often required to be kept a considerable time extended, before the fractured bones can be duly replaced, therefore those who make the extension ought to be placed so, that they may continue in the same posture for a considerable time without uneasiness, or else the operation might be interrupted. The best method of extension is by the hands, because that way the direction is sooner changed and more easily perceived, when it deviates from a right line; but if the thickness of the limb is such as prevents the hands taking firm hold of it on each side, as in a fracture of the thigh-bone; then it is advisable to extend the part by slings fastened on each side. Hence Celsus[a] observes, *Intendunt autem digi-*

[a] Lib. VIII. cap. 10. pag. 532.

tum vel aliud quodque membrum, ſi adhuc tenerum eſt, etiam unus homo poteſt, cum alteram partem dextra, alteram ſiniſtra prehendit. Valentius membrum duobus eget, qui in diverſa contendant. Si firmiores nervi ſunt ut in viris robuſtis, maximeque in eorum femoribus et cruribus evenit, habenis quoque vel lineis faſciis utrinque capita articulorum deliganda, et per plures et in diverſa ducenda ſunt; "But to extend a finger, or any "other limb that is ſlender, one man may be ſuffi- "cient, if he takes hold of one ſide with his right "hand, and of the other with his left. A ſtronger "limb requires two people, who may pull in oppo- "ſite directions. If the tendons or ligaments are "very ſtrong, as in robuſt men, and eſpecially if "the fracture happens in their thighs or legs, then "ſlings or linen bandages are to be tied round the "two heads of the bone at its articulations, and to "be pulled by ſeveral people in oppoſite directions."

2. The reduction of a fractured bone ought never to be attempted, unleſs the patient is retained immoveable either by ligatures or proper aſſiſtants. We ought not in this caſe to truſt to the ſtrength and courage of the patient, ſince the pain is frequently ſo ſevere while the fractured limb is extended, that it may oblige even the ſtrongeſt man to reſiſt and diſturb the operation againſt his will.

3. That is ſaid to be the natural poſture of the part, which it acquires when a man is at reſt, or rather in a ſleep; for then all voluntary motions ceaſe, and the parts of their own accord fall into their natural and moſt eaſy poſture. The joints are never then extended, nor yet inflected but in a ſmall degree. Now while the parts are in this natural poſture, all the muſcles are then the leaſt extended; but if the part is altered from that poſture, even againſt the inclination of the will, then thoſe muſcles will ſwell, which were deſtined to change the poſture of the limb in the ſame manner by the will. Thus, for example, the ſtrong deltoide muſcle elevates the arm; but

but if the arm be lifted up by any other perſon, the ſame muſcle will appear manifeſtly to ſwell, though not to ſo great a degree, as if the arm was raiſed by the influence of the will. But when a broken limb is extended in order to replace the bones, the muſcles muſt be elongated, which may be done with a much leſs force when they are flaccid, than when they are ſwelled or turgid. Beſides, if the limb is extended while it does not retain the natural poſture, it will require to be reſtored to its natural poſture after the bones have been replaced, becauſe it cannot continue long in any other poſition without pain; but in doing this the ſituation of the parts will be altered, and the fragments will often be forced again out of their places. This is intended by Hippocrates [b], when he ſays, *Ex quieſcente vero ac remiſſa rectitudines* (ἰθυωρίαι) *ſpectandæ ſunt velut in manu*; "You are to obſerve that the limbs "remain not ſtraight but a little inflected, like the "hand when it is not in action." And Galen in his commentary to this text ſays, *Quibus in figuris, quum otiamur, partes habere conſuevimus, hæ in curationibus eligendæ ſunt*; "That we are to chuſe that poſture of "the parts in the cure, in which we uſually place the "limbs when we are at reſt." And a little after deſcribing the natural poſture of the hands for example, he adds, *Itaque, ſi homines otiari conſideraveris, plerumque manus inter ſummam extenſionem & extremam flexionem non plane medias reperies, ſed quæ ad extenſionem propendeant:* "If therefore we conſider the poſture of the "parts in men at reſt, you will not find that the "hands or arms retain a juſt medium betwixt flexion "and extenſion, but that they incline a little from "extenſion." But Hippocrates himſelf ſays in the beginning of his book on fractures [c], (having firſt obſerved, that the extenſion both in fractures and luxations ought to be made as nearly as poſſible in a right line:) *plerumque nihil peccare illos, qui nihil prævio*

[b] De Medici officina, Textu 21. Charter. Tom. XII. pag. 87, 88.
[c] Charter. Tom. XII. pag. 153, &c.

consilio faciunt, ipse enim deligandus manum porrigit, ita coactus à justa natura, solos autem illos peccare, qui sibi plus sapere videntur; "Those generally run into "error, who do nothing with previous advice, for "such a person extends the hand to be bound up, "being so directed by unerring nature; but those "only offend, who think themselves wiser than na- "ture." He afterwards in a very ample manner, disapproves of their opinion, who bind up the hand and fore-arm in a prone posture; and he blames them still more, who prefer a deligation of those parts in a supine posture, which is much more inconvenient than the former. He then well observes, that while some bind up those parts extended, they often excite pains and other accidents worse than the injury itself; and when they order the patient to bend the joints afterwards, neither the bones, tendons, nor muscles are any longer retained in their proper situations, but the resistance of the bandage being overcome, they are removed out of their places. And in another place[d], treating of a fracture in the arm, he says, *Si autem quis brachium extendens in illa positura deliget, brachii musculus tensus alligabitur, postea autem, ubi sic deligatus cubitum flexerit, musculus brachii aliam posituram habebit*; "But if any one extends "the arm, and binds it up in the same posture, the "muscles of the arm will be bound together in a "state of tension; but when the patient, who has "been thus treated, endeavours afterwards to bend "his elbow, the muscles of the arm will acquire a "posture different from their natural one." It is therefore evident, how important this rule is in the cure of fractures. Thus, for example, the natural posture of the os humeri is parallel to the trunk of the body, when none of its muscles are in action; and therefore in a fracture of that bone, the limb ought to be retained in that posture during the extension. If the bones of the cubitus should be fractured,

[d] Charter. Tom. XII. pag. 88.

the

the limb ſhould be a little inflected at the elbow, and the hand retained in a poſition betwixt prone and ſupination. The like is alſo true of the other limbs.

4. Haſtineſs is always prejudicial here; ſince it is required to reſtore the diſplaced fragments of the bone to their proper ſituations without offering further injury to the adjacent ſoft parts within their contacts. But unleſs the extenſion be made in a right line, the fragment will offer a greater injury to the adjacent parts. But this extenſion ought to be made ſlowly or gradually, becauſe the contracted muſcles, which are often contorted or diſplaced at the ſame time, cannot be violently elongated all on a ſudden without danger of throwing them into convulſions. Therefore the extenſion of the fractured limb ought to be very gradually and equably increaſed; by which means the contracted parts may be the moſt ſafely elongated. Hence Hippocrates[e] directs, in ſetting a fracture of the humerus, to ſuſpend almoſt the whole weight of the patient, by placing a board or ſome other ſupport under the arm-pit; or at leaſt to fix it ſo that it will not give way, and then the cubitus being bent ſo as to form a right angle with the os humeri, is to have a ſoft ſtrap faſtened round it, to which a heavy weight muſt be appended, in order to make a moderate extenſion of the limb: he afterwards adds, that a ſtrong man may ſupply the place of the weight, by pulling the affected parts downwards. But it is very evident that a man, in pulling or extending the limb, ought as much as poſſible to imitate the equable force of the weight, which, being appended, elongates the parts. But the bounds of the extenſion is limited to the elongation of the limb a little beyond its natural length, as we obſerved before from Celſus, under the preceding aphoriſm; for then the fragments may be replaced without any grating againſt each other, and without intercepting any of the ſoft parts adjacent. Nor is it eaſy to offend by making the extenſion too

[e] De Fractur. Textu 3. Charter. Tom. XII. pag. 189.

great, especially in fractures of the larger bones, as in the femur, for example, which Hippocrates has well observed. But a greater or less extension will be required according as the muscles inserted into the fractured bones are stronger, by the contraction of which the limb is shortened. Whence Celsus[f] says of these fractures in the thigh bones; *Neque tamen ignorari oportet, si femur fractum est, fieri brevius, quia nunquam in antiquum statum revertitur: summisque digitis postea cruris ejus insisti: ex quo multa debilitas est; sædior tamen, ubi fortunæ negligentia quoque accessit.* "Nor ought the surgeon to be ignorant, that if the "thigh is fractured, it will be shorter, because it can "never be restored to its first state; and the leg of "that thigh will afterwards tread upon the ends of "the toes, which must be attended with much weak-"ness; but with more deformity, when negligence "also heightens the misfortune." Yet it is possible that a too violent extension may injure the action of the limb by over straining the muscles, which may cause a weakness in them, as we proved in the comment on § 25. numb. 3. But when a skilful surgeon places his fingers upon the fractured parts, while the extension is making, he can easily perceive when it is carried to a sufficient degree, or whether it is required to be yet stronger.

5. The strength of the hands is often insufficient to make an extension of the femur, when fractured in adult and strong men; whence machines have in all ages been used for this purpose. Hippocrates[g] himself describes several machines for reducing the bones of the legs and thighs, when the hands are not sufficient; and yet he observes, that it is a piece of vain ostentation to use machines when the business can be done without. Several such machines are figured in the works of Parey, Fabricius ab Aquapendente, and in the Memoirs of the Royal Academy of Sciences, in

f A. Corn. Celsi Medic. lib. VIII. cap. 10. pag. 537.
g De Fractur. Charter. Tom. XII. pag. 209, 213.

almost

almoſt all which machines the parts held firm are elongated at diſcretion by turning round ſcrews. In uſing theſe it is neceſſary to make the extenſion not by ſtarts but equably, and in ſuch a direction that they may act in a right line.

SECT. CCCL.

ALL which (348, 349.) being often impracticable without pain and violence, when the parts are already inflamed, ought therefore frequently to be omitted until the inflammation is abated: otherwiſe the patient may die convulſed, or invaded with a gangrene.

If the bones have been a long time fractured, a large tumour is uſually formed, which is often attended with acute pain and violent inflammation; but every extenſion of a broken limb, whether by the hands or machines, requires a pretty ſtrong force, and a rough handling of the affected parts. It would be therefore a piece of cruelty thus to harraſs the parts already much inflamed and in pain; ſince the ſeverity of the pain will endanger violent convulſions, or we may have reaſon to expect a gangrene from the rough handling of the inflamed parts. Hence Celſus[a] prudently adviſes, after having ſaid that the fractured limb ought to be extended: *Rurſus, ſi primis diebus id omiſſum eſt, inflammatio oritur, ſub qua et difficile et periculoſe vis nervis adhibetur, nam diſtentionem nervorum vel cancer ſequitur, vel certe, cum mitiſſime agitur, pus. Itaque, ſi ante oſſa repoſita non ſunt, poſt eam reponenda ſunt.* "Again, if the extenſion has been neglected for the firſt two or three "days, an inflammation ariſes, by reaſon of which it "will be both difficult and dangerous to apply any "diſtending force to the tendons and ligaments; for

a Lib. VIII. cap. 10. pag. 532.

"con-

" convulsions or a gangrene follow, or at least a sup-
" puration, when the whole is done as gently as pos-
" sible: if therefore the bones are not replaced before
" the inflammation is formed, they ought to be re-
" placed after the inflammation is gone off." And Hippocrates [b] speaking on the reduction of fractured bones which perforate the skin, likewise cautions that the parts ought not to be molested when there is an inflammation; and therefore, says he, the extension or reduction may be attempted on the same or on the next day: but by no means on the third, fourth, or fifth day; for then there is more danger of convulsions from replacing the bones than from leaving them untouched. He likewise adds, that there are but small hopes of success, if convulsions follow the reduction of the bones; and says it would then be better to displace the bones again, if it can be done without much difficulty. And then he directs to wait till seven or more days are expired, after which the reduction may be attempted, if the fever and inflammation are gone off. In another place of the same book [c], in treating of those fractures, in which the bone of the femur, or humerus is shattered, he observes that then the nerves, blood vessels, and muscles are lacerated; and that if the fragments are replaced, convulsions usually follow; whereas those more frequently escape, in which no reduction of those bones has been attempted.

When therefore the violent laceration of the adjacent parts, or the too great length of time which has passed before proper assistance could be had, has occasioned the parts to be invaded with great tumour, pain, and violent inflammation; we are then certain that a rough handling will be in danger of causing convulsions, or a gangrene. It is therefore necessary to remove those symptoms before a reduction of the bones can be safely attempted; or at least it is requir-

[b] De Fracturis. Charter. Tom. XII. pag. 252, 253.
[c] Ibid. pag. 257.

ed

ed to abate them as much as poſſible. Here then, plentiful bleeding, the application of emollient cataplaſms and fomentations to the injured parts, with internal antiphlogiſtic remedies, and a plentiful uſe of diacodium, are the moſt common and effectual remedies to diminiſh the pain and inflammation, and to cauſe the tumour of the parts to ſubſide. Theſe means are to be repeated according to particular circumſtances, till their effects anſwer the intention of the phyſician; and then, but not before, a reſtitution of the fragments may be attempted. But if notwithſtanding the uſe of theſe means the ſymptoms remain equally violent, or are increaſed, prudence then requires to proceed no further, and if a mortification is feared, the amputation of the limb then only remains; otherwiſe the fractured bones are to be let alone, and the whole buſineſs committed to nature. Hence it is that Hippocrates (as we obſerved in the comment to § 343.) adviſes phyſicians not to meddle with theſe caſes, when they can avoid them without reflections: for if the fractured bones are not replaced, the phyſician will appear defective in his art; and if they are replaced, the patient is nearer his death than recovery.

Although fractured bones ought to be replaced as ſoon as they poſſibly can, yet a reduction of them is not to be deſpaired of even ſeveral days after the accident. Hippocrates [d], treating of a fracture in the bones of the cubitus, having firſt deſcribed the method of binding up the fractured limb, ſays; that by the ſeventh day the fractured part becomes ſo ſlender, the whole tumour diſappearing, that the fractured bones may be then very eaſily reduced to their proper places, if they have receded from thence, or were not rightly adapted in the beginning. Hence it appears, that fractured bones may be replaced and conjoined together, after ſo long an interval of time.

[d] De Fracturis Text. XLI. Charter. Tom. XII. pag. 178.

SECT.

SECT. CCCLI.

IF the fragments are looſe, they are to be taken out, when that can be eaſily performed. If any protuberant ſplinters or ſharp points of the bone plainly hinder the extenſion, if they are within ſight, they muſt be cut off; or if they lie concealed, they muſt be firſt expoſed by inciſion. If the fracture is compound, and much complicated, and eſpecially if attended with a violent contuſion, ſplintering of the bones, or a deſtruction of the larger veſſels, it requires an immediate amputation of the limb, if nothing forbids.

The fragments and ſplinters of the bones create much trouble and difficulty in the cure of fractures, eſpecially when their ſharp points injure the adjacent ſoft parts. This too frequently happens, when the tibia, and fibula are broke at the ſame time; and it is very evident, that even the worſt conſequences may from thence ariſe, if thoſe fragments irritate the tendons and muſcles while the limb is extending. It is therefore a juſt concluſion that theſe fragments ought to be removed, eſpecially if they are free on all ſides from any coheſion; for then they impede the cure like any foreign body. Yet the ſurgeon ought always to examine firſt, whether the fragments may be extracted without much difficulty, or without offering any great injury or irritation to the adjacent parts: otherwiſe they ought rather to be left to themſelves, ſince they will be afterwards ſeparated and caſt out ſpontaneouſly. Celſus [a], in treating on this ſubject, ſays: *Si id majus eſt, membranuliſque cingitur, ſinere oportet has ſub medicamentis reſolvi.* "If the fragment "is large and covered with membranes, it is beſt to

a Lib. VIII. cap. 10. pag. 540.

"let

" let it looſen under thoſe membranes by the uſe of " medicines." But Hippocrates [b] obſerves, that thoſe medicines cauſe theſe fragments to ſeparate the moſt ſpeedily, *Quibus celerrimæ ſuppurationes fiunt, et quibus celerrime ac optime caro increſcit: etenim increſcentes carnes in parte vitiata ut plurimum oſſa attollunt.* " Which the ſooneſt cauſe a ſuppuration, and which " the beſt and moſt ſpeedily procure an incarnation: " for the fleſh growing up in diſordered parts gene- " rally raiſes up the bones." And in another place [c], treating of that caſe where there is ſome part unexpectedly caſt off from the bone, he ſays: *Signum eſſe oſſis abſceſſuri, ſi pus copioſius ex ulcere profluat, et quaſi ad exitum feſtinet* (ἢ ὀργᾶν φαίνηται) " It is a " ſign that ſome part of the bone is about to be caſt " off, if the matter is copiouſly diſcharged from the " wound, and runs haſtily in a manner to its orifice " or opening." Parey [d] predicted in himſelf that ſome part of the bone would be caſt off when he obſerved the lips of the wound ſwell, diſcharge a thin and crude ichor, and the circumjacent fleſh appear ſoft like a ſponge. But what conſiderable fragments are ſometimes thus caſt off by the aſſiſtance of nature only, is evident from the inſtance alledged in the commentary on § 343.

If any protuberant ſplinters or ſharp points, *etc.*] Sometimes it happens that the extremities of the fractured bones are ſharp pointed, which is by Celſus [e] deſervedly pronounced to be one of the worſt ſpecies of fractures, becauſe they cannot be eaſily retained in their ſituations after they have been reduced, and becauſe they wound the adjacent parts. If then the extenſion of the limb is prohibited by theſe ſharp points of the bones, nothing more remains than to cut them off if they ſtick out. Celſus [f], in treating on this ſubject, ſays: *Si acutum, ante acumen ejus, ſi*

[b] De Fracturis, Charter. Tom. XII. pag. 254. [c] Ibid. pag. 240. [d] Livre XV. Chapit. 25. pag. 346. [e] Lib. VIII. cap. 7. pag. 524. [f] Ibid. cap. 10. pag. 539.

longius

longius eſt, præcidendum; ſi brevius, limandum, et utrumque ſcalpro lævandum: tum ipſum recondendum eſt, etc. "If the ſharp point ſticking out from the edge "of the bone is long, it ſhould be cut off; but if "ſhort, it is to be raſped or filed away, and both "the points and edges are to be reduced to an even "ſurface by a ſcalprum: and after this the bone itſelf "is to be replaced," &c. Hippocrates [g] obſerves, that the eminences of fractured bones are to be cut off if they are offenſive, appear naked and troubleſome, or wound the fleſhy parts; and then he ſays: *Reliqua vero non multum refert, præcidantur necne: ſcire enim certo licet, oſſa, quæ ex toto carne nudata ſunt, et arida, omne penitus abſceſſura: a quibus autem ſquama ſeparabitur, illa præcidere non oportet, etc.* "But as for the reſt of the fragments, it matters not "much whether they are cut off or not; for you "may be very well aſſured that the bony parts "which have been laid quite bare of their fleſh, and "become dry, will all entirely exfoliate or be caſt "off: but one ought not to cut off a part of the "bone which will ſeparate or ſcale," &c. And even though it may ſeem cruel, yet it will be neceſſary to cut through the whole integuments, and remove theſe fragments when they wound the adjacent parts, or prevent the due extenſion of the broken limb. The common people uſually believe, that ſurgeons, being hardened in their practice, are often regardleſs of the miſeries of others, and ſometimes uſe the knife and cautery where more gentle methods would ſucceed with equal ſafety, though more ſlowly. But as they themſelves are ſubject to the like calamities and diſorders, it is hardly credible that they ſhould prefer a ſeverer to a more gentle method, even upon themſelves, if there were not important reaſons to urge it. But Parey, having received a very bad fracture of the leg, adviſed the expert ſurgeon who attended him not to ſpare him as a friend, but to enlarge the

[g] De Fracturis. Charter. Tom. XII. pag. 256.

wound

wound by the knife, that the bones might be more commodiously replaced, and the splinters be extracted by his fingers, at least such as were found unattached to the adjacent parts [h].

If the fracture is much compounded, &c.] If the laceration and destruction of the parts is so great, as to totally destroy the vital circulation of the humours through them, there are then no hopes left, but the whole will be in a little time corrupted: whence there only remains but one remedy in this case, namely, to extirpate the part thus affected; provided there is reason to hope that it may be performed without destroying the patient's life. For as the separation of the corrupted parts and the union of those which have been divided, depend on the circulation of healthy juices, through sound vessels; therefore if any of the larger vessels are injured, or have their structure destroyed by a violent contusion, so as to abolish the motion of the humours through the injured parts, there can be then no hopes of success without extirpation. But it must be well remarked, that this last and dangerous remedy ought not to be put in practice till we are assured there is no life remaining in the part; for we are taught by surprizing instances, that life has sometimes returned into the parts when they have been adjudged to be perfectly dead; and therefore it is best to wait at least a day or two, and in the mean time to treat the injured parts well with such antiseptic fomentations as may preserve them from putrefaction, since we are provided with such remedies of this nature by art, in which we may confide, as was said before under the cure of contusions. But to shew that we ought not immediately to have recourse to extirpation in the worst kind of fractures, it will be sufficient to alledge the wonderful case which we mentioned in the commentary to § 343. A man had the tibia and fibula miserably fractured by the wheels of a carriage loaded with several thousand weight

[h] Ambr. Paré Livre XV. Chapit. 23. pag. 334.

paſſing over his leg, which made ſuch a violent contuſion and laceration of the parts, that the whole limb might have been eaſily cut off with one cut or two of the ſciſſars. The bones were quite laid bare of all their integuments, a profuſe hæmorrhage much weakened the patient; and all the circumjacent parts being miſerably contuſed, ſwelled greatly, inſomuch that there was ſcarce any apparent hopes of preſerving life in the parts thus egregiouſly injured. But after replacing the bones, a large ſuppuration followed, attended with a great tumour and a cadaverous ſmell, which denoted the worſt conſequences to be thence feared; and therefore it was not without reaſon that a very ſkilful ſurgeon, who was conſulted, adviſed to amputate it. But the other ſurgeon, who had attended from the firſt of the accident, confiding in the patient's ſtrength and good habit, with the favourableneſs of the ſeaſon of the year, there being neither fever nor great pain, was bold enough to defer this ſevere and hazardous remedy, and by continually fomenting the injured parts with wine or its ſpirit, he prevented any putrefaction. After two month's time a large portion of the os tibiæ was ſeparated and caſt out, while the fragments of the fibula in the mean time united. The loſt part of the tibia was repaired with good callus, ſo that in the ſpace of a year the cure was compleated, and the limb perfectly recovered its uſe without any deformity, notwithſtanding the enormous injury it had received.

SECT. CCCLII.

THE reſtitution of the fragments to their proper places, is performed, by turning round the part ſo gently, ſlowly, and cautiouſly after it is duly extended (349,) and prepared (351,)

[1] Traité complet de Chirurgie par M. de la Motte, Tom. IV. pag. 284, — 290.

that

that the parts of the bone may correſpond properly with each other, and then let the diſtorted muſcles be replaced in their proper ſeats and all without intercepting any of the ſoft parts.

The ſurgeon who undertakes the cure, commits the extenſion of the fractured part to the other aſſiſting ſurgeons, or to ſervants; but the replacing of the fragments while the part is duly extended, is his own proper buſineſs; ſince the neatneſs of the cure depends entirely thereupon. Hence Hippocrates[a] obſerves, that the patient is to be ſo placed, that the affected part may be oppoſed to the light, that in its extenſion the operator may diſcern whether it continues nearly enough in a right line. If then the extenſion is ſo far continued, that the bones, which before rid over each other, can be reduced to their priſtine ſituations without injuring the circumjacent parts, then the ſurgeon may direct and replace the fragments by the action of his hands and fingers upon the fractured parts. It muſt be here well remarked, that it is not ſufficient to bring the bones together in contact, but it is neceſſary to place the fragments in the very ſame poſition which they had before the fracture: As for example, when the os humeri is fractured, the ends of the bone may be ſo adapted that the arm will remain twiſted, and the ſituation and direction of all its muſcles altered and diſturbed, whence might follow a great deformity of the limb, with a depravity of the uſes of the affected parts. Great caution is therefore neceſſary in this caſe, and the work muſt not be done too much in a hurry; for it will be much more difficult to correct afterwards an error that has been once committed. But when a due extenſion has been made, the muſcles attached to the bones, uſually reduce the fragments to their proper places by their contraction, ſo ſoon as the extenſion is

[a] De Fracturis Textu 17. Charter. Tom. XII. pag. 166.

remitted; or if they ſhould be embarraſſed or twiſted, the ſkilful ſurgeon may correct and help them, by gently turning and preſſing on them with his hands.

It muſt alſo be remarked, that the extended part muſt not be let looſe all of a ſudden, and at once, but by degrees; for otherwiſe there would be danger of intercepting ſome of the adjacent parts betwixt the fragments of the bones, which would prevent their union, and excite pain, inflammation, and other bad ſymptoms, as is ſufficiently evident.

SECT. CCCLIII.

THAT the bones are thus properly reduced, the ſurgeon knows from the anatomy of the parts, by comparing the affected part with that which is ſound, by the removal of the pains, and by the reſtitution of the part to its natural figure and length.

After it is judged that the fragments have recovered their proper ſituations, it muſt be carefully examined, before the bandages are applied, whether the reduction of the fragments is ſuch, that the other adjacent parts alſo retain their natural ſituations; and then it is uſual for the ſurgeon to aſk the phyſician preſent to examine the whole. But that they are thus replaced is known,

From anatomy.] For it is from thence that we are acquainted with the ſituation and figure of the bones. And in ſuch parts where the uncovered bones may be eaſily felt, one may eaſily diſcern whether the fragments deviate from their proper ſituations: As for example, by moving the fingers down the whole length of the ſpine of the os tibiæ. But it is not ſo eaſy to diſcover this in other parts, where the bones are covered with thick muſcles.

By

By a compariſon of the ſound part.] This is a method of the laſt importance in order to determine certainly, whether the fragments are rightly replaced. For example, if the bones of the leg are fractured, after reducing them, the diſeaſed leg is to be compared with the other which is ſound, and a careful examination muſt be made, whether the ſame cavities, protuberances, *&c.* appear in each alike. For the bulk and poſition of the muſcles it is that gives the ſhape of the limb; and if theſe appear altogether the ſame in the affected and in the ſound limb, we may be certain that all the parts retain their proper ſituations. This is what Celſus [a] ſeems to intend, when he ſays, that after the bones have been reduced to their proper places: (*At membrum alteri æquatum, involvendum duplicibus triplicibuſve pannis, &c.*) "The "limb appearing uniformly like the other, is to be "rolled up with cloths two or three times doubled," *&c.*

The removal of the pain.] When the fragments ride over each other, it is impoſſible but the adjacent parts muſt be preſſed and diſtracted; and if the fragments are ſharp pointed, they muſt neceſſarily prick and lacerate thoſe parts; whence it is ſufficiently evident from what cauſe ſuch excruciating pains frequently ariſe in fractures. But ſo ſoon as the bones are reduced, the cauſe of this pain then ceaſes, and therefore the pain itſelf immediately goes off, or at leaſt is much abated, (ſince a violent contuſion or laceration of the parts may ſometimes cauſe the pain to remain after the bones are well reduced:) and then we are aſſured, that no parts are intercepted betwixt the fragments if the pain ceaſes. Hence Celſus [b] lays it down as a poſitive rule, *Indicium oſſis repoſiti eſt dolor ſublatus*; "That if the pain is removed it is a ſign the "bone is reduced."

By a reſtitution of the part to its natural length and figure.] This may be known by comparing the

[a] Lib. VIII. cap. X. pag. 532, 533. [b] Ibid. pag. 532.

part injured with that which is found: for if the fractured bones *non adversa, sed obliqua junguntur (quod fit, ubi loco suo non sunt), membrum id altero latere brevius est, & musculi ejus tument*; "are not "joined oppositely but obliquely, which happens "when they are displaced, the limb is then shorter than "that of the other side, and its muscles swell [c]."

But great circumspection is required in comparing the fractured with the found limb; since the most skilful have been sometimes deceived in this respect. A man broke his thigh-bone near the neck, whence the fracture was at first mistaken for a luxation. The fragments being replaced (as was imagined) in their natural situations, the surgeons compared the length of the injured limb with that which was found, and the injured was found shorter than the other: but as it could be pulled as long as the other found limb without any violence, nothing amiss was suspected. Yet the patient halted after the cure, and the fractured limb was apparently shorter than the other. When they examined again and extended both the legs as the patient lay on the bed, they found that without difficulty the injured leg might be extended as long as the other; and they then found, that the os ilium of the affected side had descended in the first extension, and so gave the appearance of a false equality in the two limbs; since the flexibility of the loins easily permits the os ilium to descend with the extended thigh. Therefore when the surgeon examines whether the length of the injured leg is equal to that of the found one, he ought to be certain that the ossa ilii on each side are placed in the same line of altitude [d]; for it is possible the patient may elevate or depress the os ilium of one side to avoid pain.

[c] Lib. VIII. cap. X. pag. 532.

[d] Academ. des Sciences l'an. 1722. Mem. pag. 450. 451.

SECT.

SECT. CCCLIV.

THE retention of the bones in their ſituations is performed with bandages, compreſſes, and ſplints, by keeping the limb at reſt in a box or caſe, and by preventing or directing the action of the muſcles.

It is often much more difficult to retain the reduced fragments in their proper ſituations than is commonly imagined; and it is in this part of the cure of fractures, that the ſkill and dexterity, of the ſurgeon are principally apparent. For the muſcles attached to the bones may by their contraction diſplace the fragments out of their natural ſituations; and the ſame accident may alſo ariſe from coughing, ſneezing, moving the limb in ſleeping, *&c.* which laſt is a circumſtance lamented by Parey [a], *viz.* that in his ſleep the muſcles being ſtrongly contracted elevated his broken leg, whereby the fragments were immediately removed from their contacts, and made it neceſſary to replace them again by a new extenſion, not without extreme pain followed by an inflammation, fever, and ſuppuration. It is therefore neceſſary to ſo ſecure the injured limb, as that it may continue quite immoveable. But this is effected,

By bandages.] Various bandages are applied to fractured limbs, according as the dreſſings are required to remain a longer or a ſhorter time upon the parts before they are renewed. In a ſimple fracture a ſpiral bandage with one or two heads is ſufficient [b]. But when a wound, violent contuſion, inflammation, *&c.* attends the fracture, it would be inconvenient to remove this apparatus every day to treat the affected parts with proper remedies; for the injured limb muſt

[a] Livre XV. Chapit. 25. pag. 346. [b] Heiſter. Inſtitut. Chirurg. Tab. 2. lit. b. c.

be lifted up in order to take off and re-apply the ſpiral turns of the bandage: but this can ſcarcely be done without danger of diſplacing and ſeparating the fragments from each other. Therefore another method has been contrived by ſurgeons, namely a foliated bandage with eighteen leaves or heads, as they are often called; being formed of three pieces of linen laid over each other, and cut into three parts by two ſlits on each ſide; but ſo however that the piece of linen next the limb is the ſhorteſt, the other a little longer, and the outermoſt the longeſt of them all. This foliated bondage being moiſtened with oxycrate, or ſome ſuch liquor, is placed under the injured part, and then the two middle leaves or heads of the innermoſt piece of linen are firſt applied over the part croſſing each other, and then the reſt of the leaves croſſed over each other ſucceſſively in the ſame manner. So that it is neceſſary for the pieces of linen to be long enough to exceed a little the thickneſs of the limb to wrap over. But a better idea of this bandage may be had from figures than from any deſcription alone, for which conſult Heiſter [c], and others who have treated on bandages. But though this bandage is reckoned a modern invention, there ſeems to be one of the like make deſcribed in Hippocrates [d]. For in caſes where he expected any large fragment to ſeparate or be caſt out, he orders to take double cloths of the breadth of half a ſpan, not leſs; but a little ſhorter in length than to go twice round the limb, and at leaſt much longer than to go once round: and let theſe cloths be as many in number as the caſe may require. Having dipt theſe in black auſtere wine, he would have them applied to the middle of the affected part, in the manner uſual for applying bandages with two heads; then proceed to croſs the heads over each other, the right towards the left and the left towards the right; nor does he order them

[c] Inſtitut. Chirurg. Tab. IX. fig. 4. & Tab. XXXVIII. fig. 25. & pag. 1244.

[d] De Fracturis Charter. Tom. XII. pag. 241, &c.

to

to be in the leaſt tightened, but to be diſpoſed ſo as that the wound may appear. Galen, in his explanation of this text of Hippocrates, gives almoſt the ſame deſcription of this foliated bondage. And yet Celſus, in the cure of a fracture accompanied with a wound of the ſoft parts, makes no mention of any ſuch bandage; but he only directs to make the deligation of the part more looſely than if it was not wounded; and rather to increaſe the number of bandages, that they may ſecure it equally though looſely [e]. The great uſefulneſs of this bandage conſiſts in admitting the dreſſings to be renewed, in order to cure the wound without taking off the bandage.

But the neceſſary qualities of bandages in general are beautifully repreſented by Hippocrates [f], when he ſays, *Faſciæ parandæ ſunt leves, tenues, molles, mundæ, latæ, nullas ſutaras, neque eminentias habentes, ſatis validæ ut extenſionem ferant, pauloque fortiores, non aridæ, ſed ſucco madentes, quo quæque inebriari conſueverunt*; "Bandages ought to be provided which are "light, thin, ſoft, clean, broad, and without any "ſeams or eminencies, of a ſufficient ſtrength, that "they may bear a little ſtronger force than that ap-"plied to extend them; nor are they to be uſed dry, "but moiſtened with ſome liquor, in which it is uſual "to dip them."

It is ſufficiently evident, that the foliated bandage before deſcribed does not ſo firmly retain the parts as that which is made by ſpiral circumvolutions; and the wound, ulcer, or violent contuſion, which accompanies the fracture, would not ſupport ſo violent a compreſſure, and therefore the foliated bandage is in this caſe ſufficient. The ſpiral bandages have principally this advantage, that they retain the replaced fragments in their ſituations by an equable preſſure; and therefore it is that ſurgeons uſually bind up the fractured part with a ſpiral bandage at firſt; and if,

[e] A. Corn. Celſi Medic. Lib. VIII. cap. 10. pag. 539. [f] De Medici officina Charter. Tom. XII. pag. 62.

for example, they carried this firſt bandage from the left to the right, they then began with another ſpiral bandage upon the part, and carry it from the right to the left, in order to make the more equable preſſure, and to act principally upon the fractured part. All which is again beautifully deſcribed by Hippocrates [g], who ſays, treating on the cure of fractures of the bones of the cubitus, *Poſtea oportet faſcia deligare, principio ſupra fracturam injecto, ſic ut firmet quidem, non tamen vehementer comprimat. Ubi bis vel ter ſic faſciam ſuperduxerit, ad ſuperiora diſtribuat, quo ſanguinis affluxus intercipiatur, ibique deſinat. At primas faſcias minime longas eſſe oportet, ſecundarum vero initium ſupra fracturam injiciendum eſt, ut ſemel circa illam revolvatur, tum deorſum demittatur, lenius adſtringatur, atque ex majori intervallo circumdetur, &c.* "After "this you muſt make your deligation with a bandage, "fixing the end of it upon the fracture, ſo that it "may hold faſt, but not violently compreſs the parts. "After two or three turns thus made with your ban- "dage upon the fracture, carry it upwards, to prevent "the too great afflux of blood, and there let it termi- "nate. As for thoſe bandages which are to be the "firſt applied, they ought to be not ſo long, but the "beginning of your ſecond bandage is to be faſtened "upon the fracture and paſſed once round it, and then "let it be carried downwards, tightening it gently, "and making your circumvolutions at larger inter- "vals, *&c.*" In the ſame place he has alſo ſeveral other uſeful admonitions concerning the uſe of bandages, as alſo in Celſus [h].

Compreſſes.] It is an admonition of Hippocrates [i], that *probe noſſe oporteat, omnem faſciam ad declivia & acuminata diffugere, ut in capite ſurſum, in tibia deorſum*, "It ought to be well obſerved, that upon ſuch "parts as are acuminated, or have any declivity, all

[g] De Fracturis Charter. Tom. XII. p. 169—173. [h] Lib. VIII. cap 10. pag. 533. [i] De Medici officina Charter. Tom. XII. pag. 48.

"bandages

" bandages looſen or fly off, as in the head upwards, " and in the leg downwards." And therefore in another place he ſays [k], *quæ extremitate tenuantur, ſpleniis æquanda ſunt in orbem datis, &c.* " Thoſe " parts which are tapering towards their extremities, " are to be made even with compreſſes rolled up," *&c.* Compreſſes have therefore this principal uſe, that being properly applied, they give the affected parts a cylindrical figure, that the bandages may hold the faſter, and not ſlip off of their own accord towards a ſmaller end of the limb. Alſo when, for example, the end of the broken os femoris recedes outwards, in that caſe the preſſure of the bandage may be ſo determined by the application of compreſſes, as to act more upon the receding part, and by that means prevent the fragments of the bone from being eaſily diſplaced again that way, by the action of the muſcles, or of any other cauſe. But of what a conſiderable uſe compreſſes are in directing and preventing the action of the muſcles we ſhall preſently declare.

Splints.] Tho' the injured part may be well ſecured by compreſs and bandage duly applied, yet they will not prevent the limb from bending in the part fractured, if it ſhould be moved in ſleep, or by ſome accident; whence the ſituation of the replaced fragments would be diſturbed. For this reaſon ſurgeons fix ſplints, of thin wood or thick paſteboard (board paper) round the limb, to prevent this accident. Theſe ſplints are required to be firm enough to hinder the bending of the limb in the fractured part; being ſuch as may be eaſily adapted to the figure of the injured part, and are at the ſame time ſo light, that they prove no incumbrance by their weight. But becauſe the hollow ſtalks of the plant ferula, being very light, and yet ſtrong, induced the ancients to uſe them for this purpoſe, it is from thence that this part of the apparatus for the cure of fractures, has acquired the name of ferulæ or ſplints.

[k] De Fracturis Textu, 34. Charter. Tom. XII. pag. 173.

Hip-

Hippocrates[l] treating of them, says: *Ferulæ autem sint leves, æquales, in extremis simæ, hinc & illinc parum minores deligatione; crassissimæ autem, qua exstat fractura.* "But let your splints be light, and of the "same size, with obtuse or rounding ends; being a "little thinner in those parts where they are to be "tied on, but thickest where they cover the frac-"ture." The splints are fastened on by slight ligatures only, because they are not applied to press, but only to defend the bandage, as Hippocrates prudently observes in another place[m]; where he also adds, that care must be taken not to injure the prominent parts, which are not defended with flesh, by the application of the splints; for from thence might follow an ulcer, and the tendons might be laid bare. Hence he orders, in a fracture of the cubitus, not to place the splints by the side of the thumb or little finger, or if it is necessary to apply them so, let them be very short; for otherwise the prominent ends of the radius and ulna near the wrist would be injured. The same is true likewise in a fracture of the leg: namely, care must be taken not to let the splints touch the ancles, nor the protuberant parts of the tibia and fibula at the knee: for the whole pressure of the ligatures retaining the splints in their places, would be returned upon those parts only. I have seen an error of bad consequence, when the surgeon has neglected this caution; for a gangrene was produced at the ancles and knee, barely by the pressure of the splints upon those parts. But it is evident from what has been said before, that if only one bone is broke in those parts which have two, that then splints are not always so very necessary to be used. This is well observed by Celsus[n], who says almost the same with Hippocrates concerning splints. *Curiosius omnia in continendis ossibus fiant, si neutrum alteri auxilio est. Nam,*

[l] De Medici officina, pag. 79. Charter. Tom. XII. [m] De Fracturis Textu 14. Charter. Tom. XII. pag. 179. & de Medic. officina ibid. pag. 80. [n] Lib. VIII. cap. 10. pag. 536.

ubi

ubi alterum integrum eſt, plus opis in eo, quam in faſciis feruliſque eſt. "Every thing muſt be conducted "with greater care and exactneſs for retaining the "bones, when one affords no ſupport to the other: "But when one of them remains whole, it will of "itſelf be of more ſervice than even bandages and "ſplints." From the places before cited from Hippocrates and Celſus, it appears that they did not apply the ſplints before the ſeventh day: but the modern ſurgeons apply them at the firſt dreſſing, which Parey [o] took care to have put in practice upon himſelf.

Box or caſe.] It is alſo further required to retain the injured limb ſo ſecurely that it may remain immoveable, and as eaſy as poſſible; and as it is neceſſary for the limb to continue thus always in the ſame poſture, therefore the injured parts are to be ſo diſpoſed, that they may continue a long time at reſt with the leaſt uneaſineſs. Thus, for example, in a fracture of the leg or thigh, the articulation of the knee ought to be a little inflected; for no body can lie a long time with their leg extended. In the next place, the limb is to be ſo ſupported by pillows, that its weight may be ſuſtained by the whole length and lower ſurface of the limb, and not by one or two parts only; for that might occaſion an inflammation and a gangrene of the parts too much preſs'd. Thus a gangrene of the worſt kind has been ſometimes obſerved to invade the heel from this cauſe only. And Hippocrates [p] obſerves, that by a too long lying of the limb upon the heel, the os calcis itſelf becomes at length corrupted, and is a caſe that may be attended with the greateſt danger; becauſe when this bone is corrupted, the diſorder may continue as long as the patient lives. To avoid this accident Hippocrates [q] adviſes in another place, to fix the broken leg after it is bound up upon a ſoft plane, ſo that it

[o] Livre XV. Chapitre 23. pag. 344. [p] De Fracturis Charter. Tom. XII. pag. 200, 201. [q] Ibid. pag. 217.

may neither incline to one ſide nor the other, nor riſe higher before than behind, nor be apt to turn eaſily any way. For if the limb is not ſuſtained by its whole length, but preſſes only upon the heel and knee, an incurvation may follow in the fractured part, from the weight of the other parts. The ſame incurvation may alſo follow, if the fractured part is ſuſtained, but the foot and heel are permitted to deſcend lower than the reſt of the leg. But as for the caſes uſed to retain broken legs from moving any way, Hippocrates [r] confeſſes that he knows not what to ſay of them. They may indeed be of ſome uſe, but not ſo ſerviceable as is commonly imagined: for if the body is turned to either ſide, the caſe will not hinder the leg from following, if the patient himſelf is not cautious to prevent it; nor will it prevent the leg from being moved even without any motion of the body. But he adds, that the operator will be leſs liable to blame from the vulgar, if he uſes one of theſe caſes. But the modern ſurgeons have contrived very beautiful machines for the commodious placing and retaining a fractured limb from being moved; and which at the ſame time eaſily permit the dreſſings to be renewed in complicated fractures. Such a caſe for the retention of a broken leg, is deſcribed in the Mem. Acad. Reg. Scient. [f], and the figure and deſcription of it may be alſo ſeen in (tab. ix. lib. 11. cap. 10. § 2.) the ſurgery of the celebrated Heiſter. A commodious diſpoſition of the injured limb, and of the reſt of the body is evidently of the greateſt importance towards a cure in fractures, where the patient is obliged to lie ſo long a time; and therefore the moſt ſkilful ſurgeons themſelves ſtoop to lay the patient's bed as it ought to be [t], that they be aſſured all is right.

[r] De Fracturis Charter. Tom. XII. pag. 217. [f] l'an 1718. Mem. pag. 396. [t] Traité complet de Chirurgie, par M. de la Motte, Tom. IV. pag. 179.

By

By preventing and directing the action of the muscles.] In this the skill of the surgeon is principally apparent: for when the bones are fractured, the direction of the muscles attached to them is disturbed, if not prevented by art, and by contracting they will displace the fragments. Thus for example, if the radius is fractured, the pronator quadratus, and the ligament betwixt the radius and ulna will contract the fragments of the former towards the latter; and this injury will be still augmented by the pressure of any bandage. But if compresses are placed betwixt the radius and the ulna, this will occasion the pressure of the bandage to be returned chiefly upon the compresses, and they may prevent the radius from approaching towards the ulna. The same may also take place in a fracture of the fibula. But when the bone is fractured into several pieces, there is danger lest the contraction of the muscles should thrust out the fragments, by which means the limb might afterwards become shorter: and therefore, in such a case, it will be necessary to preserve the due length of the injured part by the application of machines that prevent contraction, till the uniting of the fragments and strength of the muscles prove sufficient for the resistance. But of this we treated in the commentary on § 346. That there is often no small difficulty in the deligation of these fractures has been well observed by Hippocrates [v], who in treating of a fracture of the heel, says, that it is not every one who is able to make a proper deligation in those cases; for if the common bandage of the ancle is applied, by passing the roller about the foot and tendon achilles, the pressure of the bandage would again displace the calcaneum. And then he proceeds to describe the best method of deligation in the same case; from whence it is evident how extremely necessary it is to have a knowledge from anatomy of the adjacent tendons and muscles, in the cure of fractures.

[v] De Fracturis Charter. Tom. XII. pag. 199.

SECT. CCCLV.

TOO tight bandages intercept the circulation, ſo as to produce a tumour and a gangrene; from whence follow infinite diſorders: they ought therefore to be gently tightened, ſo as to hold firm, and but moderately preſs upon the ſmall veſſels.

Great injuries often ariſe from too ſtrict bandages, made with a deſign to retain the replaced bones. For it commonly happens that the fractured limb begins to ſwell within a few hours time, and eſpecially about the part of the fracture; whether the tumour be a conſequence of the fracture, contuſion, or the rough treatment of the part, in order to replace the bones, and make a due extenſion: ſo that if the bandage was too tight at firſt, before this tumour appeared, it is evident that as the tumour ariſes the preſſure of the bandage will increaſe; whence follow an obſtruction of the compreſſed veſſels, an inflammation, or even a total ſtoppage of the circulation and a gangrene. Intenſe pains often ariſe from the too great ſtricture of bandages; but if the ſurgeon neglects the patient's complaint, he often finds his error in a gangrene of the part, which being corrupted, can be only remedied by extirpation. Hence all ſkilful ſurgeons carefully admoniſh to enquire into the cauſe of the patient's pain when he complains, and rather to remove all the dreſſings, than to ſuffer a deſtruction of the affected part, or even hazard the patient's life. The bad events of ſuch a neglect have been frequently obſerved, and ſeveral inſtances are related by the celebrated le Motte [a]. It will be, therefore, the leaſt hurtful of the two to make the bandage over ſlack than too tight, becauſe the former may be corrected

[a] Traité complet de Chirurgie, Tom. IV. pag. 272. &c.

by

by the application of a second bandage. But the signs by which one may know whether there is a sufficient stricture made by the bandages, are very well enumerated by Hippocrates [b], where he says, *Signa autem recte curati hæc sunt, & terminus deligandi. Si rogaveris, an prematur, & dixerit, se premi quidem sed leviter, & maxime circa fracturam. Moderationis autem indicia sunt, si illa die, qua deligatus fuit ac nocte, ipse sibi videatur non levius, sed valentius adstringi, postridie autem parvus tumor (οἰδημάτιον) in manu oriatur & mollis. Signum enim hoc tibi erit moderatæ adstrictionis. Labente jam die minus adstrictas fascias sentiat, sed tertio die laxas omnino. Scire autem licet, si quid ex dictis absit, quod justo laxior sit deligatio, si quid ex dictis superet, plus justo fuisse adstrictam.* "But the "signs which denote that the fracture hath been "rightly treated, and the deligation duly made, are, "if upon enquiry the patient affirms, that he feels a "stricture, tho' but a gentle one, and especially a- "bout the part fractured. And it is a sign the ban- "dage is not too tight, if within the first day and "night after the dressing, the patient feels the stric- "ture not diminished, but rather increased, and the "day after a slight and soft or œdematous swelling "appears in the hand or lower part. The second "day being elapsed, the patient feels the stricture "of the bandage diminished, and on the third day "it seems to be quite loose. But you may observe, "if any of the forementioned appearances are ab- "sent, that then the deligation is looser than it ought "to be, or if they exceed beyond this description, "then the bandage has been applied too tight." If that tumour which invades the inferior part of the limb below the bandage appears small, soft, and white, it denotes that the veins are but slightly compressed, from whence, with the inactivity of the part not forwarding the blood thro' the veins, it is

[a] De Fracturis Textu 37. Charter. Tom. XII. pag. 175, &c. & de Medici Officina ibid. pag. 95.

that

that the tumour itſelf ariſes; but when the parts are ſwelled above the bandage, it is a ſign that the arteries are likewiſe compreſſed, which may produce an inflammation or a gangrene. But when on the third day the bandage appears ſpontaneouſly relaxed, by the diminution of the ſwelling in the parts, Hippocrates [c] then orders the bandages to be drawn a little tighter, and to repeat the ſtricture likewiſe on the ſeventh day, if it ſhall be found neceſſary; always obſerving the cautions before given. But when the dreſſings are removed, it ought always to be carefully examined whether any of the fragments have receded from their natural ſituations, as we ſaid before at § 353.

SECT. CCCLVI.

IF there are any wounds accompany the fracture, they are to be treated according to the rules of art, as mentioned from § 185 to 239, but they ſeldom admit of deligation. The ſame is alſo to be underſtood of an inflammation, pain, tumour, and other ſymptoms attending.

If ſo conſiderable a wound attends a complicated fracture, that it cannot be ſafely left to nature; then the foliated bandage, with eighteen heads or leaves, ought to be uſed, that the wound may be commodiouſly treated without danger of ſeparating the fragments. 'Tis true, this bandage does not ſo firmly retain the part as that made by ſpiral circumvolutions; but in this caſe the wound will not permit a greater ſtricture. 'Tis an ill practice of ſome to compreſs the circumjacent parts by a ſpiral bandage, leaving the place of the wound open, or elſe by cutting out a piece of the bandage, to leave an opening over the wound: for when the circumjacent parts are com-

[c] De Fracturis Textu 40. Charter. Tom. XII. pag. 177. &c.

preſſed,

preſſed, and the wound left open, the humours are derived more forcibly and copiouſly to the wounded part; whence follow inflammation, tumour, proud fleſh, and the like. Even Hippocrates [a] has condemned this method, when he ſays; *Neceſſe eſt, ulcus in tumorem aſſurgere; nam ſi ſana caro hinc atque hinc vinciatur, in medio vero non maxime ibi tumebit, et colorem mutabit, quomodo ergo ulcus hæc effugiet? neceſſe ergo eſt, ulcus decolorari, et materiam huc exprimi, unde lacrymabitur et non ſuppurabit, oſſa vero et quæ abſceſſura non eſſent, abſcedent*; "It muſt neceſſarily cauſe the wound to riſe up into a tumour; for even if ſound fleſh is compreſſed or bound on all ſides, and left free in the middle, it will there ſwell greatly, and alter its colour; how then is it poſſible for the wound to eſcape theſe? The wound muſt therefore of neceſſity be diſcoloured, and the juices will be there forced out, whence it will not ſuppurate, but weep or diſtil a ſharp water, and bones will be ſeparated or caſt out which ought to have been retained." And he afterwards adds, that he ſpeaks of this the more largely, that every body might reject this ill method of deligation, which was uſed by many. What elſe has been ſaid concerning the cure of wounds, ought here alſo to be obſerved; and if part of the bone is laid bare by the wound, it will be convenient to uſe thoſe methods which were propoſed under wounds of the head expoſing the cranium. But a ſeldom removing of the dreſſings convenient in moſt other wounds, as we before obſerved, will be more eſpecially uſeful in theſe; becauſe great care muſt be always taken not to diſturb the ſituation of the replaced fragments.

Now altho' an exact regimen may not ſeem to be ſo very neceſſary for a ſimple fracture in a healthy perſon, yet it muſt be obſerved, that no worſe accident can happen here, than an inflammation ſupervening the fracture; for then the bandages muſt be

[a] De Fracturis Textu 49. Charter. Tom. XII. pag. 234, &c.

taken off, and such things applied as are proper to remove the inflammation, which might possibly have been better prevented. Phlebotomy therefore, with a thin diet, will be extremely convenient, more especially in those of a full habit, inclined to inflammations. Every thing must therefore be avoided which augment the quantity or motion of the circulating humours. But more especially these cautions are necessary to be observed for the first days, when there is the most danger of an inflammation. Hence Hippocrates [b] pronounces; *Diæta autem illis, quibus ab initio nec vulnus adest, nec ossa eminent, sufficit non adeo tenuis et exquisita* (ὑποφαύλη) *minus tamen cibi sumant, usque ad decimum diem; præsertim cum quiescant. Adhibeantque ex obsoniis mollibus, quæ modice alvum sollicitent, sed a vino et carne abstineant: postea paulatim se reficiant*; "But the diet for those who from "the beginning have no wound nor distortion of the "bones, need not to be so low and exact; but let them "eat sparingly until the tenth day, especially when "they have no exercise. And let them use soft shell-"fish, which gently excite to stool; but let them "abstain from wine and flesh: afterwards they may "by degrees indulge themselves." But when a fracture is accompanied with great tumour, or violent inflammation, those remedies must be speedily used, and boldly repeated according to the urgency of the symptoms, which we recommended in the cure of contusions § 334. and at the same time a very thin diet will be proper.

SECT. CCCLVII.

THEN follows a concretion or union of the parts by a callus, within the space of betwixt 20 and 70 days; sooner or later, according to the age of the patient, the thickness of the

[b] De Fracturis Textu 45. Charter. Tom. XII. pag 181, &c.

bone,

bone, the incumbent weight it is to ſuſtain, and the ſeaſon of the year.

The third thing required to be done in the cure of fractures in general (§ 347. numb. 3.) is to procure a union or concretion of the replaced and retained fragments with each other; and if there is any loſs of ſubſtance in the bone to procure a regeneration of it. But it has been cuſtomary with phyſicians and ſurgeons to call that ſubſtance a callus, by the interpoſition of which the fragments are united to each other. But what a callus is, and how it is generated, has been explained in the commentaries on § 343, and 347. numb. 3. For it there appears, that the divided parts are united, and the loſt ſubſtance repaired, by the ingeſted aliments converted into healthy animal fluids, derived to the parts thro' ſound veſſels, with a proper impetus, and in due quantities. Art does nothing more in this caſe, than replace and retain the fragments in their proper ſituations; for all the reſt is performed by the fabric of the healthy body. Therefore it need only be enquired whether any thing is defective with reſpect to health; and when that defect is known, to correct it by art: and in the commentary on § 346. we treated of the chief cauſes which have been obſerved to retard the cure, or render it impracticable.

But the time in which the fragments uſually conjoin, varies upon many accounts even in healthy people. And therefore Hippocrates [b] having ſpoken of a fracture of the cubitus conjoining within thirty days at moſt, adds afterwards: *Nihil autem perpetuum eſt: multum enim et natura a natura, et ætas ab ætate differt*; "But there is nothing of this conſtant; "for the natures or conſtitutions, as well as the ages "of patients are very different."

[b] De Fracturis Textu 41, 42. Charter. Tom. XII. pag. 179, 180.

But the chief difference of the time required for the cure of fractures depends on the

Age.] For in young ſubjects the conſolidation of the fracture is the ſooneſt made; but then in them often ariſes too great a luxuriancy of the callus. In old age the time required is much longer; for, at that time, the body rather decreaſes: whence it is found extremely difficult to procure a regeneration of the loſt ſubſtance, or a reunion of the divided parts in ſuch people. But a middle age is of all the beſt; for then indeed the fracture conjoins more ſlowly than in youth; but it unites more firmly; nor is there ſo much danger of a luxuriancy in the callus. It was ſaid in the commentary on § 346. that a fracture of the humerus in new born infants has been cured within twelve days time; whereas in adults the like cure requires thrice as long a time; and in old people the time required is ſtill much longer.

The thickneſs of the bone.] The bones vary in thickneſs according to the weight they are to ſuſtain or the ſtrength of the muſcles which they are to ſupport and direct; whence again it has been obſerved, that (*cæterisparibus*) ſo much a greater length of time is required for the conſolidation of a fracture, as the bones are of a greater thickneſs. Thus Hippocrates [b] ſays, that the os femoris takes fifty days to conjoin it; the bones of the leg and humerus, forty days [c]; thoſe of the cubitus but thirty days at moſt [d]; fractured ribs require twenty days [e], and the bones of the fingers as many days [f], *etc.* Whence the cure of fractures of the bones are uſually compleated within the ſpace of twenty to ſeventy days time; ſince within that term, the os femoris, which is the largeſt bone in the whole body, is uſually conſolidated, in a healthy man of a middle age, when no ill accident oppoſes. But when large fragments are ſeparated and removed, there is then a

[b] De Fracturis Charter. Tom. XII. pag. 223. [c] Ibid pag. 220. & pag. 191. [d] Ibid. pag. 179. [e] De Articulis ib. pag. 394. [f] De Fracturis ibid. pag. 194—197.

large

large portion of the ſubſtance of the bone to be regenerated, which will require a much longer ſpace of time: as is evident from the inſtance alledged in the commentary on § 343, where a fragment of the tibia was ſeparated, to the length of four fingers breadth; for there the ſpace of ten months was required, before the patient could ſafely ſtand upon the fractured leg.

The incumbent weight.] For the callus formed in the fractured part remains a long time ſofter than the other ſubſtance of the bone. If therefore the fractured bone is once uſed to ſuſtain the whole weight of the body, when a perſon walks, it is evident that a longer time will be required before this can be ſafely attempted. Hence a leſs time is required for the cure of the os humeri than for the bones of the leg; and more eſpecially when both bones are broken. Hippocrates [g] ſays, that a fracture of the os calcis takes ſixty days for the cure, whereas fifty days are ſufficient for a fracture of the femur: but he had before obſerved, that the os calcis is placed directly under the tibia; whence it is evident, that this bone ſuſtains the whole weight of the body. In treating of a fracture of the bones of the hand and foot he obſerves [h], that all of them are perfectly curable within twenty days, excepting thoſe bones of the foot which are connected to, or placed directly under the bones of the leg: for then thirty days are required to a compleat cure, if the patient is willing to lie ſo long, as many will not, becauſe they think the diſorder trifling, and therefore it is that moſt of them are not perfectly well cured. For the feet ſuſtain the whole weight of the body.

Therefore before the patient is ſuffered to have the uſe of his limb, the prudent ſurgeon ought to examine whether the callus is ſufficiently firm in the fractured part; to do which the limb is to be taken hold

[g] De Fracturis Charter. Tom. XII. pag. 206.
[h] Ibid. pag. 195, &c.

of on each ſide the fracture by two aſſiſtants, who are then to make a gentle attempt to bend it in the part of the fracture, while the ſurgeon in the mean time applies his fingers over the callus. If now any looſeneſs or the leaſt bending of the bones can be perceived, it is a ſign the callus is not yet ſufficiently indurated; whence might follow a new fracture or a deformity and incurvation of the limb, or at leaſt the callus, being as yet ſoft, might be expreſſed from betwixt the bones by the weight of the body, ſo as to form a protuberance, which would at the ſame time diminiſh the due length of the limb. But in the mean time, as the diſeaſed limb is obliged to be kept at reſt for ſo long a ſpace, care muſt be taken not to let the adjacent articulation become rigid; becauſe an anchyloſis or ſtiff joint has been frequently obſerved to ariſe merely from a want of moving it: and therefore during the time of the cure, the ſurgeon ought prudently to move the articulation at proper intervals, not ſuffering the patient to move it, leſt by an imprudent agitation the fragments might be again diſplaced, after they have been properly reduced.

Though the fragments have been ever ſo well replaced, yet it is beſt to make a careful examination of the parts every time that the dreſſings are renewed, and to make a compariſon with the ſound limb, in order to obſerve whether they are both of the ſame length and figure: for if any defect as yet remains, it may be corrected while the callus is flexible; for when it has accquired a bony hardneſs, it will very difficultly, if at all, admit of an alteration. Whence Hippocrates [1] juſtly obſerves, *Quod ſi alligatis ferulis ſuſpicio ſit, oſſa non recta concurrere; vel aliud quid ægrum moleſtet, ubi dimidium temporis (requiſiti ad integram curationem) præterierit, vel paulo ante, ſolvere oportet, atque iterum deligare:* "That if there is any room to "ſuſpect that the bones are not properly cloſed after "the ſplints are tied on; or if any thing is trouble-

[1] De Fracturis. Charter. Tom. XII. pag 181.

"ſome

" ſome to the patient, when half the time neceſſary " for the cure is expired, or a little before, it will " be proper to remove the dreſſings, and reapply " them again." But we need not perhaps entirely deſpair of correcting a deformity, if any remains, even after the whole time is elaſped, uſual for the cure of fractures; for obſervations confirm the poſſibility of this practice, which may ſucceed more eſpecially in younger ſubjects. A youth of ſixteen years old had a fracture of the femur, which through negligence was found, nine weeks afterwards, to be half a foot ſhorter than the other thigh; which would have occaſioned the patient to go lame all his life time: but a very ſkilful ſurgeon, examining the place of the fracture, found that the ends of the fractured bone were drawn up and conjoined by the ſides of each other. The patient being very robuſt, and the callus yet recent, induced him to cauſe the limb to be violently extended by aſſiſtants with ſlings, and by preſſing with his hands on each ſide at the ſame time, he reduced the fragments to their proper ſituations without any pain to the patient: thus the limb was reſtored to its due length ſo happily, that within the ſpace of a month afterwards the young man could walk without any manner of halting [k]. It has been even obſerved, that the fragments ſooner conſolidate in ſuch a caſe, than they unite with each other after being lately broken: which is alſo confirmed by another remarkable caſe from the ſame author [l]; namely, a man having fractured both legs, was well cured; but unluckily he broke one of his legs in the ſame place again, ſix or ſeven weeks afterwards, and within twelve days time from the reduction of the fragments, the parts were ſo firmly conjoined, that he could conveniently move and elevate the leg. This ſecond accident made the patient more cautious to avoid the like again; but three months after he was thrown

[k] De la Motte Traité complet de Chirurgie, pag. 194, &c.
[l] Ibid. pag. 242, &c.

from a horſe, and broke his leg again in the ſame place; but yet the cure happily ſucceeded, and in a ſhort time, almoſt without any deformity.

But when the ends of the fractured bones do not unite together, but in a manner cicatrize and remain ſeparated, then the caſe is much more difficult. That this accident does ſometimes happen, is evident from what has been ſaid in the commentary on § 346. And if it proceeds from a defect in the growth or nutrition of the bone, from ſome diſeaſe, there is then no remedy for it. But if the conſolidation of the bone only ceaſes for a time, as we mentioned to have been ſometimes obſerved in women with child, the cure muſt then be deferred till they are delivered. But whether or no the method which Celſus [m] propoſes, may be of ſervice in the like caſes, ſeems a matter of doubt; for he ſays, *Si quando vero oſſa non conferbuerunt, quia ſæpe ſoluta, ſæpe mota ſunt, in aperto deinde curatio eſt. Poſſunt enim coire. Si vetuſtas occupavit, membrum extendendum eſt, ut aliquid lædatur: oſſa inter ſe manu dividenda, ut concurrendo exaſperentur, et, ſi quid pingue eſt, eradatur, totumque id quaſi recens fiat. Magna tamen cura habita, ne nervi muſculive lædantur:* "But if the bones do not firmly "conſolidate, either becauſe they have been fre- "quently ſeparated or agitated, even then the cure "is not difficult; for they may unite. If the caſe is "of long ſtanding, the limb is to be extended, to "make ſome injury: the bones are to be divided by "the hand, and made rough by rubbing them a- "gainſt each other, that if any fat interpoſes it may "be rubbed off, and the whole be rendered as if it "was a new fracture. But great care is to be taken "not to injure any of the nerves or muſcles." His whole deſign ſeems to conſiſt in making a freſh wound of the bones, by rubbing them againſt each other; but if any ſplinters are thus broke off, they may occaſion much miſchief. It may perhaps be bet-

[m] Lib. VIII. cap. 10. pag. 541.

ter

ter to commit such a case to nature only, who is often observed to operate wonderfully for the patient's benefit. A man had a transverse fracture of both bones of the cubitus, at the distance of four fingers breadth from the carpus: he would neither suffer the bones to be replaced, nor any bandage to be applied, for fear of the pain, nor yet would he suffer the limb to be at rest, which prevented the consolidation of the fragments, and formed (in a manner) a new joint in the fractured part, with which he afterwards survived without any considerable pain or inconvenience. After his death, one of the surgeons who had seen the fracture, dissected the arm, and found that the ends of the upper fragment had acquired a round figure, which corresponded to cavities of the like shape in the ends of the lower fragments. The periosteum was grown thicker round the divided parts of the bone, and formed as it were a ligament to confine and strengthen the new articulation. Even the cavities formed in lower fragments were much depressed before, and much more elevated behind; so as easily to permit a flexure of the joint forwards, and prevent too great an extension of it backwards, almost in the same manner as in the joint of the elbow. These bones, we are told [n], were preserved by the celebrated du Verney, among his anatomical rarities.

Sometimes the growing callus is observed to rise above the equal surfaces of the bones, especially in younger patients, who have their solids most soft and lax, and their juices more redundant; and this happens much in the same manner as proud flesh is formed by a luxuriancy of the vessels less pressed in wounds of the soft parts. This more especially happens when the repullulating and as yet soft vessels are too much distended by the juices, too impetuously moved in a fever; for the juices are sometimes sent to the parts

[n] Nouvelles de la Republique des Lettres l'an 1685. pag. 118, &c. & in Actis Erudit. mense Novemb. 1685. pag. 513, &c.

so

ſo abundantly, that Galen [o] ſays, he has often ſeen the bloody juice poured out under the entire ſkin, that inveſts the fracture, ſo as to fill out the bandages. In ſuch a caſe, it will be convenient to uſe ſuch remedies as diminiſh the quantity of the juices, and abate their force, or drive them from the injured part. Therefore bleeding, and ſuch purges as act without inflaming, will be here ſerviceable, joined with a ſpare diet, ſufficient to ſupport life without augmenting the quantity of the juices. A gentle friction of the parts will likewiſe be of ſervice to carry off the too great redundancy of the juices there accumulated; to which add a more ſtrict compreſſure, that the too lax veſſels may be better ſecured to reſiſt the impulſe of the diſtending humours. All which are very well obſerved by Celſus [p], for if the callus grows out too much, ſo as to form a tumour in the place, he ſays: *Diu leniterque id membrum perfricandum eſt ex oleo et ſale et nitro, multumque aqua calida ſalſa fovendum, et imponendum malagma, quod digerat, adſtrictiuſque alligandum: oleribuſque, et præterea vomitu utendum, per quæ cum carne callus quoque extenuatur: confertque aliquid de ſinapi cum ficu in alterum pariter membrum impoſitum, donec id paululum erodat, eoque evocet materiam. Ubi his tumor extenuatus eſt, rurſus ad ordinem vitæ revertendum eſt:* "That limb is to be gently "rubbed for a conſiderable time, with a mixture of "oil, ſalt and nitre, and to be well fomented with "hot ſalt water, after which a diſcutient cataplaſm is "to be applied, and the bandages drawn tighter: "laxative pot-herbs, and alſo a vomit, are to be uſed, "which both diminiſh the fleſh and callus: it will "be alſo of ſome uſe to apply a fig and muſtard to "the oppoſite limb, and let it remain till it has bliſ-"tered a little, and by that it may cauſe a revulſion "of the matter. When the ſwelling is extenuated

[o] Commentario 3. in Hippocrat. de Articulis. Charter. Tom. XII. pag. 394.

[p] Lib VIII. cap. X. in fine. pag. 542.

" by these means, the patient may then return to " his ordinary course of life." But if the superincumbent weight of the body shall have forced out the callus from betwixt the bones in the form of a ring, by an imprudent use of the limb too early; in that case the limb ought to be extended again to its due length, and the exorbitant callus forced within its due bounds by an external pressure.

But when a deficiency of the callus is feared either from too great a compressure of the part, or from any other cause; then a looser application of the bandages, with emollient fomentations, and a more full diet, joined with such medicines as excite the languid motion of the juices, will be found more particularly useful. For this purpose, namely, to procure a more successful reproduction of the callus, Hippocrates [q] directs, that if the limb is unbound after the splints have been used, it ought to be fomented, and afterwards bound up more gently, and with fewer bandages than at first. And Galen [r], in his commentaries on this place observes, that Hippocrates on the first day increased his number of bandages, and applied them more strictly, till he came to the splints; but after the seventh day, laying aside the splints and the rest of the apparatus, he suffered the part to remain at rest until the twentieth day, for the nutrition of the callus; and then he derived the matter of the callus to the part, by pouring on warm water, whereas in the beginning he increased the number and stricture of his bandages, to prevent the afflux of the same matter thither. This is well expressed by Ægineta [t], when he says: *Quædam fracturæ sine callo manent, ultra definitum naturæ limitem; vel ob continuas resolutiones, vel ob immoderatas fomentationes, vel ob importunum motum, vel ob multitudinem fasciarum, vel ob totius corporis atrophiam; a quibus et tenuius membrum fieri*

[q] De Fracturis textu 43. Charter. Tom. XII. pag. 180.
[r] Ibidem. pag. 181.
[t] Lib. VI. Capit. 110. pag 101.

accidit.

accidit. Oportet igitur et alias occaſiones cum ſtudio removere, maxime autem atrophiam : partim calidioribus alimentis materiam attrahentes ad partem, uti et nutrimentum ſufficiens et balnea et eliquam animi hilaritatem ſubminiſtrantes. Signa vero callo jam firmatorum ſunt, et alia quidem, maxime vero faſcias madeſcere, nullo etiam vulnere oborto, etc. " Some fractures re-
" main without a callus, beyond the time allotted by
" nature for its formation; either becauſe of the fre-
" quent undreſſings, an immoderate uſe of fomenta-
" tions, unſeaſonable motion, a multitude of ban-
" dages, or even from an atrophe of the whole body;
" from whence alſo the limb ſhrinks or becomes leſs.
" Theſe and other impediments ought therefore to
" be ſtudiouſly removed but more eſpecially the a-
" trophe; partly by more warm or ſpicy aliments,
" and things which derive the juices to the part, with
" a ſufficient quantity of nouriſhment and the warm
" bath, with whatever elſe tends to render the mind
" chearful. But the ſigns that the bones are grown
" firm by a callus, are, among others, principally a
" moiſtening of the bandages, when there is no wound
" made, *etc.*" As for what is to be thought of the lapis oſteocolla and other ſuch remedies, to promote a callus, we have already declared in the comment on § 347. numb. 3.

But the callus with which the fractured bones are conjoined, at length puts on the nature and firmneſs of a bone; inſomuch that we are aſſured from obſervations, that the bone will afterwards break rather in any other part than in the callus, or remains of the old fracture. Yet Ruyſch tells us [t], that he found the bones of a hen, which had been broke and conjoined by nature in ſuch a manner, that only the ſpongy ſubſtance of the bone was regenerated, without the hard external lamella, which by its firmneſs naturally defends and ſecures the former. But it is evident, that bones thus conjoined may very eaſily be

[t] Theſaur. Anatomic. 8. n°. 49.

broke

broke again, and that this case sometimes happens in human bones he is apt to believe, because they are sometimes broke again by the slightest causes.

There is yet another remarkable observation in the same author [u], by which it appears, that the severest pains and symptoms may supervene in a fracture, though all proper care has been taken. For he kept by him two thigh bones, which had been so ill managed after a fracture, that the fragments rid over each other; and what was more remarkable, he found various spines or exostoses, many of which being sharp and slender might wound the adjacent parts; and these spines were not only found about the circumference of the callus of the fracture, but they also arose from the sound part of the bone above the fracture, and he perceived some of them arise out of those small holes into which the tendinous fibres are usually inserted, which fibres being tore off from the bone in a fracture or a luxation, he believed might occasion the like spines or exostoses. This opinion of his we find more largely confirmed by similar observations on the bones of other animals, which he there relates. And although it may not be easy to foresee or prevent the like accidents, yet it is thence evident, that we ought not rashly to impute those consequences to the surgeon, (who may be often one of the best merit) which no art or industry can prevent, and which may attend a fracture that has been most exquisitely treated.

[u] In Musaeo Anatomico sive Catalogo rariorum, &c. Theca A. Repositor. V. nº. 1 & 2. pag. 129, 130.

Of

Of Luxations.

SECT CCCLVIII.

A Luxation is the receding of the head of ſome moveable bone out of the cavity in which it naturally turned, accompanied with an impediment or loſs of its motion.

A luxation, called alſo a [a] diſlocation, is the diſplacing of a bone from its natural ſeat; and in this ſenſe it denotes any kind of change in the natural ſite of the bones. But from uſe, which principally determines the ſignification of words, this term has been reſtrained to ſignify only the diſplacing of bones from their articulations, where they naturally reſided. But Celſus [b], in treating on luxations, makes a two-fold diſtinction of it, when he ſays: *Moventur autem ea ſedibus ſuis duobus modis. Nam modo, quæ juncta ſunt, inter ſe dehiſcunt: ut cum latum os ſcapularum ab humero recedit, et in brachio radius à cubito, et in crure tibia à ſura; et, interdum ſaltu, calcis os à talo; quod raro tamen fit: modo articuli ſuis ſedibus excidunt:* "But the bones are moved out of their places two "ways. For ſome bones that are joined together "are ſo diſplaced, that there is a ſpace left betwixt "them: as when the broad ſcapula recedes from the "humerus, and the radius from the ulna in the cubi-"tus, and the tibia from the fibula in the leg; and "ſometimes in leaping, though but rarely, the cal-"caneum from the aſtragalus: in the other way the "heads of the bones are removed out of their places."

[a] Cael. Aurelian. Morb. Chronicor. Lib. II. cap 1. pag. 347.
[b] Lib. VIII. cap. 11. pag. 542.

Since

Since therefore a luxation, properly ſpeaking, takes place only in the articulated or moveable bones, the definition above given is a very proper one. For in every articulation there are two bones to be conſidered, that which receives, and the other which is received. The concavity in the receiving bone, which takes in the head of the other bone, is, by the ancients, termed κοτύλην; and the projecting part of the other bone, which is received into that cavity, is termed ἄρθρον, or ſimply the [c] joint. Hence we have an excellent definition of a luxation given us by Ægineta [d]; namely, that it is *elapſus articuli ex proprio cavo in alienum, à quo motus arbitrarius impeditur*: "the ſlipping out of the head of a bone from its "proper cavity, into ſome improper place, whence "the voluntary motion thereof is obſtructed:" for if the motion is not obſtructed at the ſame time, it cannot be properly called a luxation, even though the head of the moveable bone is out of its cavity in which it naturally moves. For in the wonderful articulation of the lower jaw, the round heads of that bone are indeed placed in cavities deep enough, fixed at the bottom of the oſſa ſquamoſa, whence the proceſſus zygomaticus ariſes, and yet by means of a cartilaginous elaſtic plate interpoſed between the heads of the lower jaw, they are allowed to go out of their ſinuſes, and return into them again without any injury of their motion. It was even neceſſary that this articulation ſhould admit of this motion, for the lower jaw to perform its ſeveral actions in all manner of directions.

SECT. CCCLIX.

WHICH may be done either wholly or but in part; whence we have a luxation and a diſtortion.

[c] Gotræi Definit. ἄρθρον. pag. 77.
[d] Lib. VI. cap. 111. pag. 101.

It

It is eaſily conceived that the articulated head of a bone may either ſlip quite out of its natural cavity, or elſe be ſo diſplaced as to remain partly in and partly out of its ſaid cavity. Yet Hippocrates [a] denies that this can take place in all articulations: for he concludes, that as the head of the os humeri and os femoris are round, and are received into cavities of the like ſhape, they muſt of neceſſity either go quite out of their cavity, or if they go out but in part they muſt ſlip back again into thoſe cavities. But it is ſufficiently evident, that this may happen in the other joints. Ægineta [b], in his definition of luxations, adds: *Differentias alias dicere non habemus, niſi ſolum illam quæ ſecundum majus et minus contingit. Omnino enim elapſo articulo communi generis nomine ἐξάρθρημα dicitur; leviter vero dimoto, vel uſque ad ſupercilia cavitatis prolapſo ὑπάρθρημα*; "We have no other differences "to mention, except that only which ariſes from "more or leſs: for the head of a bone ſlipt perfect-"ly out is called by the general term a luxation; "but being ſlightly diſplaced, or only ſlipt out to "the edge of the cavity, it is termed a ſubluxation." It was cuſtomary to prefix the prepoſition ὑπὸ, *ſub*, before words to diminiſh their ſignification, or denote a ſlighter affection, whence ſome phyſicians ſay parapoplexia for a ſlighter kind of apoplexy, paracynanche for a ſlight quincy, *etc.* and therefore Veſalius [c] ſeems not to have uſed theſe words with proper exactneſs, when he ſays that luxations ariſing from a flux of humours into the articulation are termed ὑπαρθρήματα; but thoſe from violence ἐξαρθρήματα. For it will appear from what follows, that a true or perfect luxation may ariſe from a flux of humours into the cavity of the joint. But it is uſual to call that ſpecies in which it is but partially diſplaced, a ſubluxation or diſtortion. And yet the term diſtortion alſo ſignifies commonly the diſplacing of muſcles or

a De Articulis Charter. Tom. XII. pag. 427. b Lib. VI. cap. 111. pag. 101. c Chirurg. magn. pag. 921.

tendons

tendons by some external violence; as it also signifies a distraction and twisting of the ligaments from the same cause. Therefore such an imperfect or partial luxation is with less ambiguity termed a subluxation.

SECT. CCCLX.

THE worst species of which disorder is, when the epiphysis or head of a bone happens to separate from its diaphysis or body.

In the larger bones which are joined to others by some moveable articulation, it is observable, that each end is distinct from the rest, or body of the bone; which is most conspicuous in the bones of abortive and new born infants. For these bones themselves were once wholly cartilaginous, and in the middle of their length, a small round grain of bone first began to appear, which soon spreading itself each way longitudinally, changes the cartilage into bone [a]. But both extremities of the bone remain a long time cartilaginous, and in the middle of these likewise the cartilage begins to change into bone, which by degrees spreads itself throughout the whole mass of the cartilage. But for a long time after there remains something of a cartilage betwixt the body and end of the bone, as, for example, in the thigh bone; by which cartilage the end seems in a manner to be glued to the body of the bone, till at length this cartilage also offifies, and causes the extremities and body to grow into one continued bone [b]; so, however, as to leave some mark or division externally for a considerable time, till at last that mark or line is also obliterated [c]. These extremities of the bones, as of the os femoris, distinguished by an intermediate cartilage,

[a] Albini Icones Ossium fœtus humani, &c. pag. 101. [b] Ibid. pag. 156. [c] Ibid. pag. 102.

or a line from the body of the bone, are called its epiphyſes; and in younger animals, theſe epiphyſes are ſeparable by a ſmall force from the body of the bone, as is daily obſerved in the firſt months. But the ligaments which every way inveſt and ſecure the articulations, grow out from thoſe places where the epiphyſes join with the body of the bone; and therefore Columbus [d] would have this to be the principal uſe of the epiphyſes; namely, that the ligaments, which are continued to no other part, might ariſe from their conjunction in thoſe places with the bones. And Havers [e] has alſo obſerved, (as we ſaid in the comment on § 343.) that in thoſe places whence the ligaments ariſe, the perioſteum, which hitherto covered the whole ſurface of the bone, there departs from it, and climbing over the ligaments which there ariſe, it proceeds to the next bone.

If therefore the epiphyſis is ſeparated from the body of the bone, it will evidently diſturb the motion of the joint. But yet it does not ſeem ſo proper to call it a luxation, becauſe the end of the moveable bone continues in its cavity, in which it naturally moves; but in the definition given at § 358. it is the receding of the head of the bone from its cavity which conſtitutes a luxation: whence this diſorder might perhaps have been better referred to fractures. Galen [f] ſeems to reckon it among the ſpecies of fractures, calling it ἄπαγμα, whereas he comprehends the other fractures under the general name κατάγματος: and he obſerves that the word ἄπαγμα is peculiar to phyſicians, being diſuſed by moſt other people; but that it ſignified that ſpecies of fracture, in which the articulating head of the bone is broke off: But as this kind of fracture is often taken for a luxation, therefore it is uſually referred hither. But this accident more eſpecially happens in luxations of the femur,

[d] De re Anatomica, lib. I. cap. 2. pag. 5. [e] Oſteolog. pag. 17, 18. [f] Method. Med. Lib. VI. cap. V. Charter. Tom. X. pag. 143.

as

as they are called, but which are very frequently a ſeparation of the epiphyſis from the body of the bone, or elſe a fracture in the neck of the femur itſelf, which is there very ſmall. For Ruyſch [g] tells us, that a celebrated ſurgeon opened the bodies of eight lame old women, and always found the neck of the femur had been fractured, but never luxated. But ſince in young infants the epiphyſes of the bones are more eaſily ſeparable by a leſs force; therefore this injury more frequently happens to them; eſpecially if an infant ſuddenly throws its body backward while it is carried in the arms; for then there is great danger of ſeparating the epiphyſes of the femur, or of breaking the neck itſelf of that bone, which occaſions them to be lame afterwards during life, while the body of the bone, being ſeparated from its head, is contracted upwards by the muſcles. But wonderful efforts of nature have been often obſerved, in order to relieve this injury: for Ruyſch found, in the body of an old woman who had this diſorder, that the neck of the femur was quite abſent, and that nature had ſubſtituted various hard, thick, and round ligaments in its place, by means of which the round head of the femur was connected to the reſt of the bone [h]. It is eaſily apparent, that the difficulty is much greater in the cure of this diſorder, than in a luxation properly ſo called; for a luxated bone being reduced in its natural ſeat, is eaſily retained there, provided the limb is at reſt: but when the epiphyſes is ſeparated from the body of the bone, the muſcles inſerted into the bone do by their natural contraction draw it from thence; whence a ſhortening of the limb, and a defect in its motion almoſt conſtantly follows.

[g] Ruyſch Theſaur. Anatom. VIII. n. 103. [h] Idem Theſauro IX. n. 74.

SECT. CCCLXI.

THE cauſe of which is ſome extending, diſtorting, or expulſive force acting externally.

No luxation can follow without ſome external force, if the inveſting and articulating ligaments are in their natural ſtate: even a very great force is required to disjoint the bones in adult and ſtrong people; as is very evident from the ſtrength of the inveſting ligaments of the joints. But any force externally applied will act in one of the three ways mentioned in this aphoriſm.

SECT. CCCLXII.

OR ſome internal cauſe, formed in the cavity of the joint, and thruſting out the head of the bone.

The ligaments which connect the articulated bones ariſing from thoſe places where the epiphyſes are conjoined to the reſt of the bone, inveſt the whole articulation in the manner of a capſule or bag, ſo as to form a cavity cloſed on all ſides; nor can they permit any thing to enter from without, nor ſuffer any thing to eſcape from within. In this cavity of every articulation are contained the two ends of the receiving and received bone, incruſted on all ſides with a cartilage; and in the larger articulations, furniſhed with conſiderable glands, denominated from Havers, their firſt diſcoverer. One large gland of this kind is ſeated in the articulation of the femur, and four or five ſmaller are viſible in the articulation of the knee [a]. Beſides theſe, there are many ſmaller follicles or

[a] Clopton Haverſ. Oſteolog. pag. 190—201.

drains

drains in the ſurface of the ligament which inveſts each articulation. Theſe glands, which by anatomical injections appear to conſiſt of innumerable ſmall veſſels, ſerve to ſeparate and furniſh a mucus, like the white of an egg [b], and of a brackiſh taſte. But the cartilaginous ends of the bones contained in the cavity of the articulation, not being covered with any perichondrium, ſeem to tranſude a thin medullary oil, which is lodged in conſiderable quantities in the cavernous parts of the bones, near their articulations. In the larger bones of a horſe, Dr. Havers [c] could perceive theſe pores with his naked eye, through which the medullary oil tranſuded into the cavity of the articulation; and the ſame thing is confirmed by many other experiments. For when the joints of a dead body are preſerved entire until all the mucilage is gradually conſumed, or perhaps abſorbed, a mere oil is found in their cavities, which the ſame author has alſo obſerved in the joints of the fingers [d]. Animals that are killed, after long and violent exerciſe, have very little medulla in the cavities of the larger bones; whereas in well fed and idle animals the medulla abounds. From all which it ſeems to be ſufficiently evident, that the medulla of the bones, tranſuding their extremities, mixes with the mucilage ſeparated by the glands; ſo that from a mixture of theſe two is formed that liniment with which the extremities of the articulated bones are anointed and lubricated, that they may ſlide eaſily upon each other without much attrition. And for this reaſon when the fat or oil is wanting, or conſumed by too much labour, old age, or diſeaſes, a grating or crackling of the joints is perceptible, from the attrition of the too dry ends of the bones againſt each other. Add to this alſo, that the thin dew or vapour is likewiſe diſcharged from the ſmalleſt exhaling arteries into the cavities of the joints, as well as into all the other cavities of the

[b] Clopton Haverſ. Oſteolog. pag. 200. 206. [c] Ibid. pag. 173. [d] Ibid. pag. 372.

body, whether large or ſmall, with which we are as yet acquainted.

There is therefore a threefold humour meets in the cavities of the joints; namely the univerſally perſpiring vapours, the medullary oil, and the mucilage ſeparated by the glands there ſeated; from all which mixed together, ariſes that lubricating liniment, which being attenuated by the warmth and mutual attrition of the bones, is returned or abſorbed in the ſame quantity in which it was ſent into the joint: but if the abſorption or return of this liniment is from any cauſe impeded or diminiſhed, while the ſecerning and expulſive cauſes continue, the liniment will be then accumulated ſo as to diſtend and weaken the ligamentary capſule of the joint; whence the prolapſion of the articulated head of the bone from its proper cavity may eaſily ariſe from this cauſe. That tumours of a conſiderable magnitude often ariſe about the joints from this cauſe, is teſtified by innumerable practical obſervations. And Havers [e] demonſtrates, that the medullary oil which tranſudes thro' the cartilaginous ends of the bones into the cavity of the articulation, is very apt to concrete or ſtiffen, if not duly attenuated by the motion and attrition of the bones againſt each other. For he tells us, he has often obſerved this oil ſtagnant and concreted in the pores (through which it uſually tranſudes) in ſuch animals as have been fattened without uſing exerciſe; and that at the firſt view he imagined the ſame to be ſmall glands, but he afterwards found them to be nothing more than a concreted oil.

This cauſe of luxations, with many more particulars relating to this diſorder, we meet with in Hippocrates [f]; for in treating on the articulations, he ſays, *Mucus omnibus natura ineſt, et quum purus fuerit, ſani ſunt articuli, ideoque facile moventur, utpote lubrici inter ſe. Labor autem et dolor oritur, quando a*

[e] Clopton Haverſ. Oſteolog. pag. 174. [f] De Locis in homine cap. 3. Charter. Tom. VII. pag. 361.

carne

carne laborante fluit humor. Imprimis quidem rigescit articulus, non enim lubrica est humiditas ex carne affluens. Deinde utpote copiosa et valde dispersa, neque ex carne irrigata, semper reficcatur; quumque illam ob multitudinem articulus capere non possit, effluit, maleque concrescens nervos, quibus articulus colligatur, attollit, relaxat et dissolvit: et ob illud claudi fiunt magis minusve, prout illud magis minusve fit; "That all of them "are naturally supplied with a mucus, which when "pure, or of a healthy consistence, the articulations "are found, and therefore easily moveable, as being "slippery upon each other. But pain and a difficult "motion arises in the joint, when the juices flow to "it in too great a quantity from a bad habit of body; "for their moisture distilled from the vessels or flesh "is not lubricating, and therefore the articulation will "more especially become stiff. On the other hand, "the articulation will also become stiff or dry, when "the mucus is too abundantly and powerfully dissi-"pated, and not supplied again from the soft parts; "and when the dried mucus is so redundant, that it "cannot be confined within the articulation, it then "escapes, and causes a bad concretion or rigidity of "the ligaments which connect the joint which is thus "distorted, relaxed or dislocated: and from hence "the patient becomes lame more or less, according "to the degree of the disorder." And, in another "place [g], *Quibus ab ischiade diuturna vexatis ischium excidit, et rursus incidit, illis muci innascuntur*; In "those who have the head of the femur slip in and "out, after being long afflicted with sciatica, there is "an accumulation of the mucus."

If now we also consider that inflammation may arise in these parts, since the ligaments and glands of the articulations appear, from anatomy, to be furnished with innumerable arteries; from hence therefore a suppuration may follow, with an accumulation of the formed matter within the cavity of the articulation,

[g] Sect. VI. Aphor. n. 59. Charter. Tom. IX. pag. 289.

etc. and by these means may be produced all those symptoms which arise from a collection of the mucilage of the joints from not being absorbed or returned again into the blood. That luxations very frequently arise from this cause, we are assured by M. Petit [h], who ingenuously confesses that he learned this from his own errors. For when by a fall, or other accident, the trochanter major is urg'd upwards, it is evident that the head of the femur will be very forcibly pressed into the acetabulum or cavity in which it moves; whence the glands and round ligament there seated may suffer a violent contusion, which we know is often followed with an inflammation, suppuration, and accumulation, either of matter or mucilage within the joint. The ligaments being thus distracted and weakened, will be no longer able to retain the head of the femur in its situation, and the muscles inserted in the trochanters drawing the femur upward, will force out the head of that bone from its acetabulum, which will occasion an incurable lameness afterwards. 'Tis hard to discover this disorder at first, as the luxation follows not for a long time. If we know that such a contusion in the joint has preceded, and there remains a troublesome pain in the articulation, then bleeding, with a thin diet and cooling medicines are required, to prevent the inflammation, or remove it when present. It will be also very serviceable to keep the part at rest, and apply convenient fomentations; and thus may a luxation be prevented, when it is about to follow from this cause; and which being once formed, seems to be incurable.

[h] Academ. des Sciences l'an 1722. Mem. pag. 159, &c.

SECT.

SECT. CCCLXIII.

THESE luxating cauſes (361, 362.) are aſſiſted by every thing which extends, relaxes, or breaks the ligaments, whether the cauſe from whence they ariſe be external or internal.

'Tis the coheſion of the ligaments only which retains the articulated bones in their proper ſituations; which ligaments are required to be flexible, that they may give way to the various motions of the joints; and at the ſame time they are required to be ſo firm, as not eaſily to ſuffer too great elongation. It was before demonſtrated, in the commentary on § 25. numb. 3. that too great a diſtraction is juſtly enumerated among thoſe cauſes which weaken the ſolid parts of the body; whence too great an extenſion of the ligaments may diſpoſe the joints to be eaſily luxated afterwards, tho' it does not immediately produce the luxation. The ſame is alſo true, if the ligaments do not ſufficiently reſiſt the diſtending cauſes, either through ſome weakneſs in themſelves, or from a general relaxation of the whole habit. Therefore Celſus [a], in deſcribing the general cauſes of luxations, ſays: *Omnes articuli, cum validis nervis comprehenduntur, excidunt aut vi expulſi, aut aliquo caſu nervis vel ruptis, vel infirmatis; faciliuſque in pueris et adoleſcentulis, quam in robuſtioribus*; "Since all the articulations are inveſted with ſtrong ligaments, they "are diſplaced either by ſome expulſive force, or "from a weakneſs or rupture of the ligaments by "ſome accident; whence they more eaſily happen "in children and young people, than in thoſe who "are ſtrong." It is univerſally well known, that the ſolid parts are weaker and ſofter, or more eaſily diſtracted in young ſubjects; tho' there are even ſome adult, and otherwiſe ſtrong people, who are found to

[a] Lib. VIII. cap. 11. pag. 543.

have

have a great laxity of almoſt all the ligaments of their joints; and there are often tumblers, or poſture-maſters, that expoſe themſelves for a public ſhew, who by the action of their muſcles only, can luxate almoſt all their joints, and again replace them by the ſame means, ſo as to make their bodies turn almoſt into any ſhape, like a piece of wax. Hence Hippocrates [b] juſtly obſerves, *Quod in luxatis facile reſtituendis multum naturæ a naturis differant, et multum cavum a cavo diſtet: nam hoc quidem facilius, illud difficulter ſuperatur. Multum etiam differt nervorum colligatio, quibuſdam laxa, quibuſdam tenſa, etc. Complures autem videre licet, qui ita humidi ſunt, ut, ubi velint, ſine dolore articulos ſuo loco moveant, et ſine dolore reſtituant*; "That there is a great deal of difference in "luxations, as to their being more or leſs eaſily re-"duced, according to the different nature of the "joints, the cavity of one being much deeper than "that of another; ſo that the bone will more eaſily "ſlip out of one than the other. There is alſo a "great deal of difference in their connection by the "ligaments, ſome of which are lax, and others tenſe, "*etc.* And we meet with ſeveral who have their "joints ſo moiſt, that they can diſplace them, and "reſtore them again when they pleaſe, and that with-"out any pain." He afterwards adds, that fleſhy joints do not ſlip out ſo eaſily; but then they are more difficultly replaced, when out; whereas in lean people they are more eaſily replaced. He then confirms his diſcourſe by the inſtance of oxen, which being emaciated towards the end of the winter, do very eaſily ſuffer a luxation of the femur.

But if the ligaments have been broke by any external violence, or if their continuity has been diſſolved by any ſuppuration, eroſion, *etc.* it is very evident that then a ſlight force may luxate the joint.

[b] De Articulis, Textu 23, etc. Charter. Tom. XII. pag. 304, etc.

SECT.

SECT. CCCLXIV.

HENCE follow an alteration of the figure of the limb, with a tumour, excavation, a ſhortening or an elongation thereof; a diſtraction, immobility, and numbneſs, or palſy of the muſcles below the joint; a compreſſure of the adjacent veſſels, followed with pain, watchings, inflammation, an œdema, anchyloſis, convulſion, a withering, and death, either of the part or of the whole body.

This aphoriſm comprehends thoſe ſymptoms which uſually accompany or follow after luxations.

An alteration of the figure, a tumour, or excavation.] Celſus [a], in deſcribing the ſigns which accompany every luxation, ſays, *Siquidem ſemper ea parte tumor eſt, in quam os prorumpit; ea ſinus, à qua receſſit*; "That there is indeed always a tumour in that "part to which the bone is thruſt; and a ſinus or "cavity in the part from whence it receded." But ſuch an unuſual tumour and preternatural excavation more eſpecially appear when the diſlocated joint is not much loaded with fleſh, as in the ſhoulder and elbow: for in the thigh it is very difficultly diſcerned, becauſe of the many muſcles and circumjacent far which inveſt the articulation. But in order to determine with certainty whether or no the joint is diſlocated, Hippocrates [b] wiſely directs to compare the injured limb with that which is ſound: *Ad exemplum enim integri æſtimare vitiatum oportet, neque ſpectare alterius hominis articulos, (quibuſdam enim hominibus magis prominent articuli, quam aliis) ſed ipſius laborantis, an integer vitiato diſſimilis ſit*; "For the figure of the "injured limb ought to be compared with that of a

[a] Lib. VIII. cap. 11. pag. 543. [b] Hippocrat. de Articulis. Textu 34, etc. Charter. Tom. XII. pag. 310.

"found

" found one; and this not by inſpecting the joint " of another perſon, (for in ſome people the joints " are more protuberant than in others,) but by ob- " ſerving whether the ſound limb differs from that " which is injured in the patient himſelf." But an alteration of the figure alone is not ſufficient to demonſtrate that any joint is diſlocated, for as Hippocrates [c] likewiſe obſerves; *Multi enim articuli præ dolore, aut alia de cauſa, licet ipſis non exciderint, nequeunt tamen eo modo, quo in ſanis corporibus, figurari*; " Many joints, through pain or ſome other accident, " are prevented from reſembling the figure of the " ſame joints in healthy bodies, even though they " are not diſlocated." Even though a preternatural excavation ſhould appear in the place of the articulation, unleſs an uſual tumour alſo appears in another part where the head of the bone is thruſt, a perſon may be egregiouſly deceived, eſpecially in the joint of the ſhoulder. Hippocrates [d] even ſays, that he knew ſeveral phyſicians of note, who believed the humerus was luxated, when they ſaw a cavity upon the ſhoulder from the depreſſion of the head of the humerus below the acromion: and Galen [e], in his commentary on this text of Hippocrates, relates that he had met with the ſame accident in himſelf. For when he was in the field of exerciſe, the maſter of the field perceiving a preternatural cavity in his ſhoulder from the raiſing of the acromion, imagined that the head of the humerus was prolapſed into the axilla, which occaſioned him to extend Galen's arm, and to make a needleſs attempt to replace the bone: but this being done with a violent extenſion made by ſeveral aſſiſtants, Galen himſelf endeavoured with the fingers of his other hand to reduce the head of the humerus, but Galen finding no preternatural protuberance in the axilla, adviſed them to forbear making

[c] Hippocrat. de Articulis, Textu 34, &c. Charter. Tom XII. pag. 311. [d] Ibid. Textu 62. pag. 321.
[e] Ibid. pag. 322, 323.

any

any farther extenſion; but they notwithſtanding continued their extenſion, imagining that Galen requeſted them to forbear by reaſon of the pain; and if one more prudent than the reſt had not come to his aſſiſtance, they would have pulled off the muſcle. But by this perverſe treatment, Galen perceived that a convulſion was beginning to invade his arm, and which he could not keep off, but by the continual pouring on of warm oil; as we mentioned once before upon another occaſion in the commentary on § 164. From hence it is evident, how much caution is neceſſary in order to determine whether a joint is luxated, ſince the moſt ſkilful have been ſometimes miſtaken. Thus I ſaw an unhappy countryman, whoſe whole arm was invaded with a gangrene up to the ſhoulder, which being ſwelled with a true phlegmon, was by an ignorant fellow deemed and treated as a luxation of the cubitus, though by his ſtrong and repeated extenſions, he made the people imagine he excelled every body in the cure of fractures and luxations.

A ſhortening or elongation of the limb.] When the head of the bone is diſplaced from the cavity in which it ought naturally to move, then the muſcles, which are inſerted into that bone, do naturally contract and draw it upwards; whence it happens, that the diſlocated limb is generally ſhorter than the other, in the manner we deſcribed in the commentary on § 343. in treating on the ſhortening of a limb from a fracture of its bones. But in ſome caſes, though not often, the diſlocated limb is elongated; and this happens when the diſplaced head of the bone is ſo ſuſtained, that the muſcles cannot draw it upward. Thus for example, the lower jaw being luxated on both ſides, as Celſus [f] obſerves, *totum mentum inclinatur, et in exteriorem partem promovetur, inferioreſque dentes longius, quam ſuperiores excedunt, intentique temporum muſculi apparent*; " The whole chin will be

[f] Lib. VIII. cap. 12. pag. 544.

" inclined

" inclined downward, thruſt forward, the lower teeth " will come out much beyond the upper, and the " temporal muſcles will be found upon the ſtretch." For the heads of the lower jaw being prolapſed beyond the tubercles, which are placed before the cavities of its articulations, therefore they cannot be drawn back by the muſcles of the lower jaw, which will therefore project out beyond the upper jaw. And Hippocrates [g], treating on luxations of the femur, reckons it one of the ſigns which denote the femur to be luxated inwards, when the injured limb being compared with the other appears longer. For ſays he, *Oſſi enim, quod à coxa ſurſum procedit ad pectinem, femoris caput inhæret, et cervix articuli cavo ſuſtinetur*; " The head of the femur is ſuſtained againſt " the bone, which is continued upwards from the iſ- " chion to the pubis, and the neck of the femur is " ſuſtained againſt the cavity of the articulation :" and for theſe two reaſons he judges the diſlocated limb is rendered longer than the other. A ſhortening of the limb will therefore happen the moſt frequently and yet an elongation of it may likewiſe happen ſome times: but the caſe is ſtill more rare for the luxated limb to be exactly of the ſame length with the ſound one; yet Hippocrates obſerves, that this may happen when the head of the femur is diſplaced forwards; though he alſo adds, that ſuch a luxation is ſeldom to be met with.

Immobility.] All thoſe motions, whoſe performance requires the diſplaced joint to be in its natural ſtate, can either not be performed at all, or at leaſt but with great difficulty: and it is certain that all the motions of a limb cannot be performed in a true luxation, as they were uſually performed when the limb was ſound. As for inſtance, in the articulation of the humerus in its natural ſtate, *a* perſon may deſcribe an infinite number of cones with his extended arm, the vertices of all which cones may be conceived to ter-

[g] De Articulis, Charter. Tom. XII. pag. 399.

minate

minate in the cavity of the articulation, while their baſes are deſcribed by the ends of the fingers: but if the head of the os humeri be diſplaced from its articulation with the ſcapula, thoſe motions cannot be performed. The ſame is alſo true of the other articulations. Yet all the motions of a joint are not continually deſtroyed by a luxation; for frequently ſome of the motions remain, as Hippocrates[h] well obſerves. For after having treated of ſuch as have their arms ſhorter from the day of their birth, either from a luxation in the uterus, or from ſome other cauſe, he ſays, *Quibus vero virili ætate humerus excidit, nec reſtitutus fuit, ſummus humerus attenuatur, et magis excarnis fit; ubi autem dolore liberantur, non æque præſtare poſſunt opera omnia, quæ requirunt, ut cubitus à pectore diductus in latera attollatur. Ad ea autem valent, quæcunque perficienda ſunt, humero vel in priorem partem, vel in poſteriorem, ad pectus adducto: nam terebra, ſerra, ſecure, etc. utuntur, dummodo cubitum non admodum alte attollere neceſſe ſit, etc.* "But in thoſe who "have a luxation of the humerus in their adult age, "without a reduction of it, the upper part of the "arm becomes very ſmall, and loſes much of its "fleſh; and even thoſe, who are free from pain, "cannot well perform all the motions required to "raiſe the arm, and move it from the breaſt to the "ſide. But any perſon is able to perform theſe mo"tions when the humerus is diſplaced either forwards "or backwards, being drawn towards the breaſt: for "theſe ſecurely uſe the ſaw, the terebra, &c. provi"ded it is not neceſſary to raiſe the arm up very "high." Hippocrates alſo points out in ſeveral places of the ſame book, treating of the different luxations, which of them deſtroy the motion of the joint, and in which of them the motions continue. So that under theſe reſtrictions an immobility of the limb is reckoned among the conſequences of luxations.

[h] De Articulis, Textu 61. Charter. Tom. XII. pag. 320.

A diſ-

A diſtraction of the muſcles.] The head of the diſplaced bone muſt neceſſarily preſs upon and diſtract the adjacent muſcles; and at the ſame time the ſituation of the muſcles inſerted into or attached to the bone will be altered; whence ſome of the muſcles will be ſhortened and others elongated. And on the ſame cauſe likewiſe depends the change of figure in the luxated limb. M. Petit [i], enumerating the ſigns which denote that the head of the femur is prolapſed backwards, obſerves that the glutei muſcles are relaxed, but that the triceps ſeems like a very tenſe chord extended from the region of the pubis to the middle of the os femoris. When each head of the lower jaw is luxated, it is evident from the anatomical ſtructure of the parts, how greatly the temporal muſcles will be diſtended, *etc.* whence often convulſions and death itſelf follow.

A ſtupidity or numbneſs of the ſubjacent parts, or a palſy.] Theſe happen when the prolapſed head of the bone compreſſes the large nerves adjacent; or as when the ſpinal medulla itſelf is compreſſed by a luxation of the vertebræ. Hippocrates [k], in treating on a luxation of the ſpine, obſerves, that when the upper part of the ſpine is diſlocated inwards, the whole body becomes ſtupid and relaxed (*νενάρκωμένοι*) or paralytic. See what has been ſaid in the commentary on § 170. numb. 1. γ. If now the head of the os humeri ſlips into the cavity of the axilla, it will compreſs the large trunks of the nerves which are there ſeated, whence it is evident that theſe ſymptoms will invade the parts below. When the head of the os femoris is luxated forwards, among other ſigns of its being ſo luxated Hippocrates [l] reckons a ſuppreſſion of urine, becauſe then the head of the femur will be near the large nerves. But it would rather ſeem, that a compreſſion of the nerves ſhould produce an invo-

[i] Academie des Sciences, l'an 1722. Mem. pag. 163.
[k] De Articulis, Charter. Tom. XII. pag. 390, 391.
[l] Ibid. pag. 422, 423.

luntary discharge instead of a suppression of the urine. But Hippocrates [m] in another place takes notice, that if the spinal medulla is injured by any cause, at the first the patient neither voids the urine nor fœces; but when the disorder becomes inveterate, he discharges them both without his inclination; from whence it appears, that a suppression of urine may sometimes follow a compression of the nerves. If therefore the nerves destined to sense and motion are entirely compressed, it will form a compleat palsy with insensibility; but if the compression is only slight, it will impair and not totally abolish all the functions of the nerves; the subjacent parts will then suffer a torpidity, as Galen [n] well expresses it, being a disorder betwixt a palsy and perfect health of the parts.

A compressure of the adjacent vessels.] In the same manner as the head of the os humeri, prolapsed towards the axilla, often compresses the adjacent large nerves, so may it likewise compress the adjacent large blood-vessels which are there seated; and thus it may impede the influx and reflux of the blood to and from the subjacent parts; whence may follow a gangrene or a withering. See what has been said on this head in the commentary on § 161. and § 166.

Pain.] Such a disposition of a nervous fibre arising from the brain, as threatens a rupture or solution of its continuity, excites the idea of pain in the mind, as we said before in § 200. But a joint cannot be dislocated without a violent distention of the ligaments investing the articulation; and so long as the bone remains displaced, so long will the ligaments be distended beyond their natural state: from whence pain, and that in no small degree, always accompanies every recent luxation; and which pain generally ceases, or at least much abates, so soon as the bones are replaced. Hence therefore luxation is deservedly

[m] Prorrhetic. Lib. II. cap. 11. Charter. Tom. VIII. pag. 819.
[n] De locis affectis, Lib. II. cap. 4. Charter. Tom. VII. pag. 404.

reckoned among the cauſes of pain § 224. numb. 3. If now we alſo conſider, that the perioſteum departs from the bones at their articulations, and continues on its courſe over the ligaments (ſee the commentary on § 343.) it will evidently appear, that the ligaments cannot be diſtracted without ſtraining the incumbent perioſteum in like manner, which being extremely ſenſible, may be another cauſe of pain. But when the diſlocated bone has not been replaced for ſome time, the ligamentary fibres are ſo weakened by the continual diſtraction (ſee § 25. numb. 3.) that they more eaſily yield or elongate without danger of breaking; whence the pain is gradually diminiſhed, and at length ceaſes. (ſee § 228. numb. 1.) But the circumjacent parts, which have been compreſſed and rubbed for ſo long a time by the diſlocated head of the bone, become at length callous and inſenſible: We obſerved before, in ſpeaking of the immobility, which follows luxations, that thoſe are at length freed from their pain who have not had the diſlocated bones reduced, and that they can alſo perform various motions of the joint eaſily enough. And Hippocrates [o], in treating on a luxation of the femur outwards, ſays, *Ubi caro, in quam articulus exceſſit, jam trita eſt, et tenax evaſit, dolor tempore ceſſat. Quando autem dolore liberi ſunt, ingredi ſine baculo poſſunt, ſi alioquin velint, poteſque affecto crure ferri corpus*; "The "fleſhy parts, into which the head of the bone has "receded, become at length tough or callous by the "attrition, and the pain in time ceaſes. But when "the patients are free from pain, they are capable "of walking without a ſtick, if they ſo pleaſe, and "the weight of the body may be ſuſtained by the "affected thigh." For as Gorræus [p] obſerves, the word γλίχρον, *tenax*, denotes in the ſolid parts a toughneſs or callofity; but in the fluids, a lentor or viſcidity.

[o] De Articulis, Charter. Tom. XII. pag. 411.
[p] Definit. Med. pag. 133.

Watchings.] In the commentary on § 226. we reckoned *vigilia* or watchings among the effects of pain; and as it was before proved, that pain accompanies a luxation, it is evident that watchings ought to attend likewise, so long as the intensity of the pain continues.

Inflammation.] It will appear in the subsequent dissertation, that an inflammation attends whenever the impervious juices stagnate in the smaller vessels, and are urged on behind by the increased force of the circulation in a fever, by which the juices are pressed and ground together. Obstruction therefore supposes a quicker circulation of the humours. But in the commentary on § 112. it was demonstrated, that any force, which compresses or elongates the flexible vessels, diminishes their capacity, and may therefore be the cause of obstruction. But in a luxation the ligaments, tendons, and muscles, attached to the bones, are elongated: the dislocated bones compress the adjacent soft parts, and from both these an obstruction may follow as the effect of a luxation. But a fever is reckoned among the effects of pain, (on § 226.) from whence it is evident that those two causes attend in luxations, which are sufficient to produce inflammation; namely obstruction, and a swifter motion of the blood arising from the fever and pain which accompany every luxation. But how violent the fever and pains are, which follow from luxations, is taught in several places by Hippocrates[q]; for says he, *Humeri osse in cubiti articulo versus priorem partem luxato, nisi statim reponatur, graves et vehementes inflammationes sequuntur. Si vero versus posteriorem partem eruperit, maximum dolorem movet, et validissimas febres continuas, cum meracæ bilis excretione, et paucis diebus lethales, excitat*; "The os humeri being luxated forwards at its articulation with the cubitus, is followed with most violent and intense inflammations, if

[q] Hippocrat. de fracturis, in fine libri. Charter. Tom. XII. pag. 266, 267.

" it is not immediately reduced; but when it is dis-
" located backwards, it occasions most severe pains
" and a violent fever, with a discharge of real bile,
" and proves fatal in a few days." And the same he affirms, in treating on a luxation of the cubitus, in his book of the articulations [r]. And in another place, treating on a luxation of the jaw, he observes [s], that it ought to be reduced with the utmost expedition; for if it be not replaced, the patient's life will be in danger from the continual fever: and he then adds, that these patients usually void pure bile in small quantities by stool, and if they vomit, they bring up the like humour.

Œdema.] It was said in the commentary on § 112. numb. 1. that by this name even all preternatural tumours were called formerly; but that afterwards it was restrained to those tumours only, which are soft, indolent, and yield to the pressure of the fingers. Such a kind of tumour is generally seated in the cellular membrane only, from an accumulation of the lymph stagnating in the cells of that membrane. But luxations are generally accompanied with this tumour, when the dislocated bone compresses the larger veins; for thus the motion of the venal juices is impeded. so that the thin dew exhaled by the arteries into the cavities of the cellular membrane, cannot be duly absorbed by the veins, whence being accumulated and stagnant, it is converted into water or ichor, as it is termed by Hippocrates.

Anchylosis.] Celsus [t] tells us, that joints contracted with a recent cicatrix or callus were by the Greeks termed ἀγκύλας: but that a stiffness or immobility of a joint was also called ἀγκύλας and ἀγκυλώσεις, we are told by Ægineta [u]; and that the cause was an infarction of the humours or a contraction of some of the ligaments. Anchylosis therefore denotes an inflexibility

[r] Hippocrat. de fracturis, in fine libri. Charter. Tom. XII. pag. 331. [s] Ibid. pag. 340. [t] Lib. V. cap. 18. nº 28. pag. 257. [u] Lib. IV. cap. 55. pag. 70. versa.

of

of a joint, which is frequently accompanied with a preternatural tumour. But for the joints to continue moveable, it is neceſſary for the heads of the bones to retain their proper figure and connection where they are articulated together, and to have their extremities evenly covered with a very ſmooth cartilage, lubricated with the proper liniment; and laſtly, the ligaments themſelves, which encompaſs the joint, muſt have a due degree of flexibility. But by luxations all theſe requiſites are ſometimes either deſtroyed or perverted: for the ligaments, being broke or violently diſtracted by the diſlocation of the bone, become inflamed; as they alſo may from that force which is required to extend the bones and reduce them. But this inflammation may terminate either in a ſuppuration or a gangrene; whence the ligaments will afterwards remain rigid and contracted. Alſo this diſorder of the ligaments will impair the ſecretion of the lubricating mucilage of the joint, which will be leſs than uſual; whence again the motion of the joint will be impeded.' While the ligaments are inflamed, moſt ſevere pains will ariſe from the leaſt motion of the joint, which being therefore kept at reſt, the liniment of the joint will not be ſufficiently attenuated and abſorbed; this therefore being accumulated, and deprived of its more thin and fluid parts, will at length concrete into an irreſolvable maſs, which will totally deſtroy the motion of the joint. If again the ſurface of the cartilage is wounded or abraded either in the diſlocation or reduction of the head of the bone, or is ſome other way injured, this may be another cauſe of an anchyloſis.

Convulſion.] The moſt acute pain, diſturbing the whole common ſenſory, is frequently attended with convulſions: as was ſaid before in § 226. and from hence a convulſion may follow a luxation. But beſides this, a luxation is often accompanied with a conſiderable diſtortion of the muſcles, and diſtraction of the tendons, which alone may be ſufficient to produce

a convulsion. For we know by daily experience, what a severe pain and contraction of a muscle follows, commonly called the cramp, when any of the tendons of the muscles moving the fingers or toes are displaced. Hippocrates [w] observes, that in a luxation of the bones of the leg, accompanied with a wound, if the heads of the bones next the foot are perfectly dislocated either outward or inward, they ought not to be reduced; for if they are reduced, the patient survives but a few days, and expires with convulsions. The same bad consequence is to be expected, he says [x], if the bones of the cubitus are so dislocated at the wrist, that they burst out through a wound: and he then adds [y], that if a convulsion follows the reduction of the bones, they ought speedily to be displaced again, and the parts must be afterwards fomented at times.

A withering.] When the larger arteries or nerves tending to any part, are from some cause obstructed, so that they cannot properly distribute their respective juices necessary for the life and nutrition of the parts; a true marasmus or wasting of those parts thence follows; since all the vessels are contracted and collapsed, from their present juices being dissipated, without any fresh supplies. A surprizing instance of such a withering is related in the commentary on § 161. where the axillary artery being totally divided, the whole arm afterwards dried up like a mummy. When therefore, for instance, the head of the os humeri is so prolapsed as to compress those large vessels in the axilla for a considerable time, it is evident that the like accident may be reasonably expected.

But Hippocrates [z] has also remarked another cause of this withering: namely, when the dislocated bones have not been reduced. For, in treating of a luxation of the

[w] De Articulis, Charter. Tom. XII. pag. 435. [x] Ibid. pag. 443. [y] Ibid. pag. 445. [z] Ibid. pag. 203. & sequentibus.

femur,

femur, he says, that if this happens to those who are not yet grown to their full stature, and no reduction has been made, the thigh, leg, and foot is by that means rendered shorter; *neque enim ossa similiter in longitudinem augentur, sed breviora fiunt, femur præsertim. Crus item universum sine carne et musculis fit, et effœminatum et tenuius; partim quod articulus suo loco motus sit, partim quod nequeat suo munere fungi, quia non secundum naturam disponitur. Nam usus aliquis id, quod valde effœminatum est, confirmat; solvit etiam aliquid ex eo, quod augeri membrum in longitudinem prohibit. Potissimum autem læduntur, quibuscumque, dum in utero sunt, hic articulus elabitur; deinde quibus id accidit, dum in ætate sunt admodum tenera; minime quum jam robusti sunt*; "for then the bones are not "equally augmented in their length, but they, and "especially the femur, become shorter. The whole "leg also becomes feeble, slender, and almost without flesh or muscles; partly because the limb is "dislocated, and partly because its functions are disturbed or abolished, from its vessels being not naturally disposed. For the use of any limb that is "feeble corroborates it; but every thing which prevents the growth or elongation of the limb, causes "it also to decay or waste. But those have this injury in the most considerable degree, who have "suffered a dislocation of the femur while in the "uterus; and next, those to whom this has happened when they were very young; but those are the "least injured hereby, who are already strong and "lusty." But this withering, he observes [a], is chiefly seated in the parts nearest to the dislocated joint; which he proves by the instance of those who have had a dislocation of the humerus from the birth, or at least before they have acquired their full growth; for in these the humerus is shorter, and the cubitus, with its adjoining hand, something less than the sound. He likewise adds, that they can generally perform

[a] De Articulis, Charter. Tom. XII. pag. 408.

moſt kinds of work almoſt as well with the injured as with the ſound limb: But when the head of the femur is diſlocated inwards, he ſays, that the fleſh is waſted the more, becauſe they cannot uſe the limb. Hence that withering which follows the diſlocation of a joint, which has not been reduced, cannot be always aſcribed to the compreſſion of the larger veſſels, but it often reſults likewiſe from the defect of the muſcular motion in the limb thus injured: and therefore Hippocrates [b] remarks, that when the femur is diſlocated outwards in adults, and has not been reduced, the bulk or fleſhyneſs of the parts is not ſo much diminiſhed, becauſe the limb does not loſe its motions or uſe. For the fleſhy parts, amongſt which the head of the bone is protruded, become at length tough and firm by attrition, ſo that the patient can ſtand or walk on it without a ſtick. But after this, Hippocrates [c] deduces a general axiom from theſe obſervations, and ſays: *Quæcumque in corpore ad aliquem uſum facta ſunt; ſi quis moderate utatur, exerceatque in eo laboris genere, cui ſingula aſſueverunt; hoc pacto bene valent, augentur, et ad bonam ſenectutem deducuntur. Si in uſu non ſint, ſed otioſa maneant, morboſiora fiunt, non augentur, et brevi ſeneſcunt: id præcipue accidit nervis atque articulis, niſi quis illis utatur*; "Every part of the body made for ſome action, being moderately uſed, and exerciſed in that ſort of "work to which each part is accuſtomed, does by "that means become healthy, increaſe in bulk, and "conduce to a good old age: But if they remain "idle, and without exerciſe, they become more diſ-"eaſed, do not grow luſty, and bring age on apace; "and this holds true principally in the ligaments and "joints, unleſs a perſon uſes them." But what a conſiderable effect exerciſe has, in reſtoring from the aliments thoſe parts which are continually waſted by the actions of a living and healthy body, has been al-

[b] De Articulis, Charter. Tom. XII. pag. 411. [c] Ibid. pag. 42.

ready

ready demonſtrated in the commentary on § 25. numb. 2. and § 28. numb. 2. If again we alſo conſider, that the tendons, muſcles, ligaments, *etc.* contract or ſhorten, and at length become rigid if they are not moved; and that the veſſels of our bodies collapſe, and cloſe by their own contractile power, from a diminution of their diſtending cauſes; it will be from thence evident why the parts ſhrink or waſte, after the motion of a limb is impeded by a luxation.

All that Hippocrates has ſaid in different places concerning this withering of the parts, is collected together by Celſus [d], and expreſſed in a manner no leſs conciſe than elegant: *Ac, quibus in pueritia exciderunt (articuli) neque repoſiti ſunt, minus quam cæteri creſcunt: omniumque, quæ loco ſuo non ſunt, caro emacreſcit, magiſque in proximo loco, quam in ulteriore; ut puta, ſi humerus loco ſuo non eſt, major in eo ipſo fit macies, quam in brachio; major in hoc, quam in manu. Tum pro ſedibus, et pro caſibus, qui inciderunt, aut major aut minor uſus ejus membri relinquitur: quoque in eo plus uſus ſupereſt, eo minus id extenuatur*; "As for "limbs which have been diſlocated in childhood, and "which have not been replaced, they grow leſs than "the reſt; for the fleſh or muſcles of every diſtorted "limb conſumes or falls away, and this more in the "parts near the luxation than in thoſe which are "more remote: As for inſtance, if the humerus is "diſplaced, there happens a greater waſting in that "than in the fore-arm, and a ſtill greater in the fore-"arm than in the hand. Add to this, that more or "leſs of the action of the limb remains, according "to the different ſeats and cauſes of the luxation; "and likewiſe, the more the action of the limb re-"mains, the leſs is it extenuated or waſted."

The obſervations of the moſt ſkilful ſurgeons likewiſe confirm this doctrine. A youth ſitting down in a meadow, was drawn by the leg by a playful girl,

[d] Lib. VIII. cap. 11. pag. 544.

whereupon

whereupon a pain enſued in the articulation of the femur, which was yet but ſlight. A very ſkilful ſurgeon being called, upon the ſtricteſt examination could find no ſigns of a luxation, but imagined the pain aroſe from the diſtraction of the muſcles and ligaments inveſting the articulation; and therefore he only applied ſome linen cloths dipped in ſpirit of wine to the affected parts, and retained them by a ſuitable bandage. The careful mother, who expected to have ſeen a much more formidable apparatus uſed, called in a country fellow, who was by the ignorant common people believed to be a great maſter in reducing luxations. The ruſtic ſo forcibly extended the falſly ſuppoſed diſlocated limb that he actually diſplaced the head of the femur inwards from its cavity; as it evidently appeared, after the ſevere pain, tumour, and inflammation of the parts were removed by proper remedies. For the injured leg was two inches longer than the ſound one. As the patient was not yet arrived to his full growth, the ſurgeon predicted that there would be a deficiency in the future growth of the injured limb in proportion to that of the reſt of the body: the truth of which aſſertion was afterwards proved by the event; for when the whole body was grown four inches higher, the injured leg was about two inches ſhorter than the ſound, notwithſtanding they were at the reduction both of the ſame length [e].

Death of the part or of the whole body.] Among the effects or conſequences of pain, we reckoned a gangrene § 226. which is that ſtate of the ſoft parts in which they tend to death or mortification, by being deprived of their vital influx of blood, by the arteries and reflux of the veins. The ſame diſaſter alſo frequently happens from a violent inflammation, which is ſo general an attendant on luxations. When the bones of the leg are diſlocated at the foot with a wound, Hippocrates [f] obſerves, that to attempt a re-

[e] De la Motte Traité complet. de Chirurgie, Tom. IV. pag. 367—375. [f] De Articulis, Charter. Tom. XII pag. 437.

duction

duction would cauſe a gangrene to invade the leg and foot. If therefore the larger veſſels are ſo compreſſed or injured by the luxation, as to intercept the vital influx and reflux of their juices, a death or mortification of the part is at hand; as it alſo is when the reduction of the bones is attempted while the violent inflammation continues. For the ſtrong extenſion and rough handling which are required in the reduction, often cauſe the inflammation to turn ſpeedily to a gangrene. An unfortunate caſe of this nature is related by the ſagacious author [s] lately cited. An unſkilful perſon attempted to reduce the elbow, which was diſlocated in a ſervant man the day before, and this notwithſtanding a violent inflammation occupied the adjacent parts of the articulation; for he had called into his aſſiſtance two ſtrong men, who moſt violently extended the part. By the next day a gangrene had extended itſelf up to the middle of the arm, and the patient's life could be ſaved no other way than by amputating the limb. But that death itſelf of the whole body is likewiſe often the conſequence, may ſufficiently appear from what has been already ſaid in the commentary on this aphoriſm: for we obſerved that a luxation of the jaw is often attended with violent convulſions and death; and Hippocrates obſerved, that violent fevers ariſe after a diſlocation of the cubitus. The ſame he alſo obſerves, when the larger bones are ſo diſlocated that they ſtart thro' a wound; for then convulſions and death are at hand if they are replaced; and if they are let alone, even then life is often in danger.

SECT. CCCLXV.

FROM a knowledge of all which ſymptoms, we are furniſhed with the demonſtrative ſigns of a preſent luxation.

[s] De la Motte, &c. Tom. IV. pag. 359.

To

To be satisfied of the luxation of any joint, the first enquiry must be whether a cause sufficiently violent has preceded, by the force of which the head of the bone might be displaced: and whether this cause was external (§ 361.) or internal, residing in the cavity of the articulation (§ 362.) And then enquiry must be made whether the articulating ligaments have been overstrained or broke by a too violent external force preceding; or whether the ligaments are so relaxed from any cause, that they do not firmly retain the joint which they invest, of which we spoke in § 363. After it appears from hence, that there is just ground to suspect a luxation, we must then diligently enquire after those signs which demonstrate that a luxation is present. And the chief of these are a preternatural tumour from the head of the bone being displaced into some other part, with an unusual cavity in the place where the head of the bone was naturally seated. But to make the diagnosis certain, both these signs ought to attend; for either of them alone is often found fallacious. We gave an instance of such an error in the commentary on the preceding aphorism, committed on no less a person than Galen himself, whose humerus was mistakenly supposed to be luxated, from the appearance of a preternatural cavity made by the distortion of the acromion, without any unusual tumour appearing in the adjacent parts. And thus I saw an inflammatory tumour formed in the groin by a fall, mistaken for a luxation of the femur; when at the same time the girl being of a lean habit, one might easily perceive by the touch that the articulation was right, and that there was no preternatural cavity. It is a strong confirmation of the diagnosis, when the motion of the limb, which depends on the natural conformation of the joint, is totally destroyed, or else very much depraved. And if at the same time, by comparing the injured limb with that which is sound, there appears a considerable difference

in

in their figure and length, there ſeems then to be no room to doubt of a luxation.

The diagnoſis of a luxation is however ſometimes very difficult: for if the inflammation ariſing from a violent contuſion, diſtortion, *etc.* has cauſed a conſiderable tumour to be formed round the joint, it will be neither eaſy to perceive the protuberance nor the preternatural cavity which is there formed; while at the ſame time all the motions of the joint are prevented by the intenſe pain. In ſuch a caſe, therefore, one ought chiefly to conſider whether the antecedent cauſe was ſuch, as that one might from thence reaſonably expect a luxation. Nor will it be of any bad conſequence to ſuſpend our judgment in ſuch a doubtful caſe; becauſe the violence of the inflammation will render it dangerous to reduce the luxation: therefore that ought to be firſt removed by proper remedies, and then the affected parts may be more diſtinctly examined.

But how much caution is often required in diſtinguiſhing luxation, is evident from the caſe which Galen [a] relates. A man diſlocated his arm in the field of exerciſe: the phyſician upon comparing the injured limb with that which was ſound, could perceive no difference; whence he too haſtily concluded that the part was injured with a contuſion, but that the articulation was ſound. He therefore ordered the patient to the bath, and after covering the part with woollen cloths dipped in wax and oil, to compoſe himſelf to reſt. But as by theſe means the pain did not abate all night, on the day following, the phyſician full of indignation (becauſe others more unſkilful than himſelf were conſulted) readily confirmed and perſiſted in the diagnoſis which he made the day before, and ſaid, that the humerus was inflamed by the pain, and that therefore he would have the ſame means continued. But on the third day, the pain

[a] In Commentario primo in librum Hippocrat. de Officina Medici. Charter. Tom. XII. pag. 6.

being

being nothing abated, and Galen being called into consultation, he found indeed, that the affected shoulder had no preternatural cavity in the place of the articulation, but that it was rather more tumid than the other shoulder; but thrusting his fingers under the axilla, he immediately perceived the head of the humerus was lodged there, and therefore determined there was a luxation. It was the comparison of the injured limb with that which was sound, which deceived the first physician; whereas upon Galen's enquiry, the patient owned, that by a fall from a chariot he had formerly broke off the acromion of the other shoulder, which the physician supposed to be sound and natural, though it had thence an apparent excavation; so that by comparing the two shoulders together, the same cavities appearing in each, led the first physician into an error.

After the existence of the luxation is ascertained, it is farther required in the diagnosis to determine towards which part the bone is prolapsed, whether inwards, outwards, upwards, downwards, *etc.* for many things necessary towards the prognosis and cure depend on this determination. Much light will be afforded in this affair from the anatomical knowledge of the various connections and articulations of the bones, with a consideration of their movements resulting from the particular disposition of each joint. But the particular quarter towards which the head of the bone is displaced, may be also determined from the same consideration of their motions; and therefore Hippocrates, and all the best proficients after him, have very diligently collected all the signs by which one may distinguish the different modes of dislocation in the same joint. Thus, for instance, he observes, that if the injured arm cannot be extended, the cubitus is dislocated backwards; and, on the contrary, that when the joint is luxated forward, the cubitus cannot be inflected [b]: and in treating on the se-

[b] Hippocrat. de Articulis, Charter. Tom. XII. pag. 331.

veral

veral luxations of the femur [c], he accurately remarks the signs proper to each, *etc.* which seem unnecessary to be here repeated.

SECT. CCCLXVI.

AND from having considered the size, figure and situation of the accident, with the intercepted or compressed parts; the age of the dislocation, and its degree of concretion; with the pain, inflammation, convulsion, or other symptoms in the circumvesting parts, which are of a more or less slender or gross texture; also the ligaments themselves, being either broke or elongated, with their annexed muscles, *&c.* From all these is deduced a prognosis indicating whether the cure will be compleat or defective; speedy or slow; and easy or difficult.

After the luxation is apparently demonstrated by the diagnostic signs, every circumstance mentioned in this aphorism ought then to be duly considered, in order to form a certain prognosis of the bad consequences that may be feared from the known luxation, or from that force which will be necessary to reduce the dislocated bones. For all these ought to be intimated, at least to the patient's friends, if not to himself, lest the supervening accidents, which are by no means avoidable, should be imputed rather to ignorance or neglect in the surgeon, than to the violence of the disorder. But the principal enquiry in the prognosis is, whether such a cure may be expected, that the limb will afterwards recover all its usual motions; or whether only some of the usual motions of the dislocated limb will remain, and those not absolutely the same as they were before the luxation. For thus is distinguished whether the cure will be

[c] Hippoc. de Articulis, Charter. Tom. XII. pag. 398. & sequent.

compleat

compleat or defective. It ought alſo to be further determined, whether the cure may be compleated in a ſhort ſpace of time, or whether a longer interval will be required to reſtore the limb to its due ſtrength. For if, for example, the ligaments have been violently ſtrained, or otherwiſe relaxed, ſo as to loſe their ſtrength before the accident, a ſpeedy cure cannot be expected. But the cure may be ſaid to be eaſy when only a ſlight extenſion is neceſſary to reduce the luxation, which is not attended with any very bad ſymptoms. But, in the contrary caſe, one may juſtly foreſee, that the cure will be attended with difficulty when it requires a violent extenſion, and moſt or all of the aſſiſtances of art. "It is the buſineſs of a quack "to magnify a ſlight caſe, that his performance may "appear the more conſiderable," ſays Celſus [a]. *Hiſtrionis quidem eſt, parvam rem attollere, quo plus præſtitiſſe videatur*; but it can never be amiſs to repreſent the prognoſis rather on the more difficult ſide; for if the ill conſequence ſupervenes, they will reflect that it was predicted to them: but if every thing ſucceeds happily, the happy event will merit praiſe to the ſurgeon. But what conſequences are to be feared, will be evident from the following conſiderations.

Size or magnitude.] The magnitude of a luxation is meaſured by the diſtance which is intercepted betwixt the head of the bone, and the cavity from whence it was diſplaced. But it is evident, that the farther a bone has receded from its cavity, in which it naturally moved, the more will the inveſting ligaments be diſtended, even ſometimes to a rupture; and the greater diſtraction alſo will the adjacent tendons and muſcles ſuffer, whence extreme pain, inflammation, *etc.* follow. It is alſo equally evident, that a luxation may be the more eaſily reduced, as the head of the bone is nearer to the cavity from whence it was diſplaced. Whence Celſus obſerves [b],

[a] A. C. Celſi Medic. Lib. V. cap. 26. pag. 283.
[b] Lib. VIII. cap. 15. pag. 549.

it will be much more eaſy to reduce the humerus when it is diſlocated forwards, than when its head is prolapſed into the axilla.

Figure.] It was ſaid before (on § 364.) that a luxation is attended with an alteration of the figure of the limb; therefore the greater this alteration, which is obſerved by comparing the ſound and injured limb together, ſo much the greater change is there in the ſituation of all the circumjacent parts, and ſo much greater is their extenſion or diſtortion; all which will apparently augment the difficulty of the cure. But the figure of the diſlocated joint itſelf may cauſe a great deal of difference in this reſpect; as for inſtance in a diſlocation of the humerus, if the head of the bone is lodged before its proper cavity, by relaxing the parts after a due extenſion is made, the bone eaſily ſlips into its place. But in the os femoris the caſe is very different. For the head of that bone with its ſlender neck forms an obtuſe angle with the reſt of the deſcending body of the bone; whence it will be here neceſſary to uſe another artifice. For though by a forcible extenſion the diſplaced head of the bone may be brought over againſt its proper cavity, yet it may very eaſily ſlip upwards and paſs over its laterally placed cavity: whence Hippocrates [c], treating of the reduction of the os femoris when diſlocated inwards, ſo diſpoſes the whole apparatus, as that the ſurgeon's hand may preſs laterally and urge the bone into its place when the head comes over-againſt its cavity.

Situation.] If we conſider thoſe wiſe obſervations which Hippocrates [d] has made concerning the different directions of a luxated femur, it will ſufficiently demonſtrate what a conſiderable difference may ariſe in the effects of a luxation from this cauſe only. For if the femur is diſlocated inwards, and cannot be replaced, as it frequently happens,) then the muſcles or fleſh, which encompaſs the diſlocated bone, fall away,

[c] De Articulis, Charter. Tom. XII. pag. 455.
[d] Ibid. pag. 399. & ſequentibus.

and the action of the limb will be much vitiated. But the ill consequence will be much less if the head of the femur is dislocated outwards: and therefore Hippocrates [e] makes this general inference; *Circa coxas magna differentia est, versus interiora aut versus exteriora, luxatum esse: circa genua quidem differt, sed minus. Modus autem claudicationis utrisque proprius est: nam quibus in exteriorem partem procidit, vari magis fiunt; minus autem recti stant illis, quibus in interiorem partem luxatur. Similiter autem & si circa talum luxatio facta fuerit; si enim versus exteriorem partem, vari quidem fiunt, sed stare queunt. Si versus interiorem partem exciderit, valgi quidem fiunt, minus vero stare possunt*; "With respect to the hip or joint of the femur "there is a great deal of difference, according as it is "luxated either inwards or outwards; and with re- "spect to that of the knee there is also a difference, "but less than in the former. But there is a particu- "lar mode of halting proper to each of these: for "those who have the femur dislocated outwards, have "their leg turned rather inwards; but those do not "stand so upright, who have the femur luxated in- "wards. The same likewise holds in a luxation of "the ankle; for if the foot be dislocated outward, "they can stand, and are termed *vari:* if it be dislo- "cated inwards, they cannot so well stand, and they "become *valgi*."

The parts compressed or intercepted.] What sad disorders may follow, when dislocated bones compress the adjacent parts, is no where more evident than in a luxation of the vertebræ of the spine; for then the spinal medulla included within their cavity is compressed, contused, and sometimes wounded. And here the consequences are always more fatal, as the luxation is seated higher up towards the head: and therefore a luxation of the head itself, (by the slipping back of its glenoide processes, by which it is connected to the uppermost of the vertebræ,) is by Cel-

[e] De Articulis, Charter. Tom. XII. pag. 406.

sus

sus [f] justly pronounced fatal. *Nervi sub occipitio extenduntur, & mentum pectori agglutinatur, neque bibere is, neque loqui potest: interdum sine voluntate semen emittit, quibus celerrime mors supervenit*; "The nerves "below the occiput are extended or obstructed, the "chin is pressed close to the breast, nor can the pa- "tient either drink or speak; and sometimes there "is an involuntary discharge of the semen, which "symptoms are soon followed with death." And he afterwards observes [g], that those are much in the same condition who have a luxation of the vertebræ of the spine, but that they do not die so soon as one who has luxated the head, but yet that they die within three days time. He also there enumerates those very bad consequences which follow a perfect luxation of the vertebræ; that is, when they are wholly displaced: for then he says, the spinal medulla, its membranes and nerves, must of necessity be ruptured. But if the vertebræ are only distorted a little outwards, he proposes a method of cure out of Hippocrates. See also upon this subject what has been said in the commentary on § 364. concerning the numbness and palsy of the parts below the dislocated joint. But if in reducing the dislocation the parts of a nerve, tendon, muscle, blood-vessel, or the like should be unfortunately intercepted betwixt the bones, it is evident that the most excruciating pains, convulsions, *&c.* may thence follow. But such an interception cannot easily happen, if a due extension of the parts precedes the reducton of the luxation.

Age or continuance.] Hippocrates [h] lays it down as a general rule, that luxations ought to be reduced immediately, or at least as soon as possible. For he observes, that the reduction may be more easily made before the part begins to swell, and the patient will then likewise suffer less pain. And the most celebrated surgeons, who always provide their whole appa-

[f] Lib. VIII. cap. 13. pag. 546. [g] Ibid. cap. 14. pag. 547.
[h] De Articulis circa finem. Charter. Tom. XII. pag. 466.

ratus of dreſſings in order, before they reduce a fracture, do nevertheleſs immediately reduce a luxation, and then provide the neceſſary bandages and other things proper for retaining the reduced bones [i]. Even if a fracture ſhould unluckily accompany a diſlocation, the latter is always reduced before the fracture is touched; partly for the foregoing reaſons, and partly becauſe the reduced fragments might be diſplaced again by the force required to reduce the luxation [k]. But if the joint has continued diſlocated for ſome time, the parts affected ſoon ſwell, inflame, and become extremely painful; whence there might be danger of inducing a gangrene by a rough handling. Alſo the ligaments, which have been long diſtracted, loſe their ſtrength; whence the reduced joint may be very eaſily diſlocated again. And the conſiderable glands, which are ſeated in the larger articulations, being ſet free from the compreſſure by the head of the bone, or elſe inflamed, may ſwell ſo as to greatly diminiſh the cavity of the joint; whence the reduction will become difficult, and the retention ſtill more difficult. Add to this, that the mucilage or liniment lubricating the joint, and which uſed to be attenuated and diſperſed by its conſtant motion, will now be accumulated, and often reduced into ſo thick a maſs, that it can afterwards be diſſolved by no art, but fills up the cavity of the joint, ſo that there is no longer any room for receiving the head of the bone. If again it be conſidered that an inflammation often follows, unleſs the luxation is ſpeedily replaced, which may cauſe a deep ſuppuration, (as Hippocrates [l] obſerves in treating on a luxation of the thigh,) the reaſon will be very evident why many bad conſequences may be foreſeen in the prognoſis, if the diſlocation continues any conſiderable time before its reduction is attempted.

[i] De la Motte Traité complet de Chirurgie, Tom. IV. pag. 358.
[k] Ibid. pag. 398.
[l] De Articulis, Charter. Tom. XII. pag. 411.

A con-

A concretion.] It is well known that all parts of the body contiguous to each other are prevented from growing together by the intervention of a thin vapour like dew, which repleniſhes all the larger and ſmaller cavities of the body. But when this dew is abſent, the parts which were before ſeparated ſoon grow to each other. Now when the parts are inflamed, the great diſtention of the larger veſſels compreſſes theſe ſmaller exhaling ones: whence follows that dryneſs of the parts in inflammations, which cauſes them readily to cohere and grow together. Thus the lungs are almoſt conſtantly found adhering to the pleura after a pleuriſy or peripneumony. Therefore the head of the bone now diſplaced, and deprived of its natural liniment, will readily cohere and grow to the adjacent parts, which are alſo at the ſame time inflamed by the violent diſtraction or compreſſion which they endure. From whence it is evident that the reduction muſt be then impracticable. But we have already ſeen, that the cavity of the joint likewiſe may be ſoon filled by a luxuriancy of the glands or an inſpiſſation of the mucilage. And perhaps too the bony cavity itſelf may ſhrink and grow gradually leſs from the abſence of the diſlocated head of the bone; for we ſee, that after the evulſion of a tooth, the ſides of the jaw compoſing the alveoli do by degrees cloſe and meet together, till they are at length ſo united, that no mark of the ſocket of the tooth remains.

Pain.] A recent luxation is always accompanied with pain, as we ſaid before in the commentary on § 364. But if this pain is extremely excruciating, the worſt events may juſtly be feared: becauſe it denotes that the aching parts are in ſuch a ſtate as tends to a total diſſolution of their continuity, (ſee § 220.) Alſo the worſt conſequences of extreme pain, enumerated in § 266, may be thence expected; more eſpecially as the reduction of the luxated bones requires a forcible extenſion of the parts already full of

pain; whence there may be danger of convulsions, delirium, a gangrene, &c.

Inflammation.] How an inflammation comes to be a consequence of a luxation has been explained in the commentary on § 364. For it is almost a constant attendant, unless the dislocation was speedily reduced. But when a violent inflammation has invaded the dislocated part, it is in the utmost danger. For unless the luxation is reduced at first, it will be very difficult to do it afterwards: and if the parts are roughly handled during the inflammation, a gangrene may follow in a little time. But in such a case, of two evils the least is to be chose; and therefore it will be best to relinquish the reduction until the inflammation is removed or abated by proper remedies. This is also the opinion of Hippocrates [m], who, in treating on the most dangerous luxations, says, *Eodem die restituendæ sunt, vel sequenti; tertio vero aut quarto minime. Ubi enim usque ad quartum diem duraverint, maxime recrudescere videmus. Ubi ergo non protinus recondantur, his diebus supersedendum est. Contineri enim solet, quod intra decem dies conditur*; "That they are "to be reduced the same day or the day after; but "by no means on the third or fourth day. For "when they have been neglected until the fourth "day, we have observed the worst symptoms attend. "If therefore they are not immediately reduced, "those days are to be passed over in expectation; for "it usually happens that they may be reduced within "ten days." And in another place [n], speaking of a luxation of the cubitus, he lays it down as a general rule: *quod nullum articulum, dum febris adest, in suam sedem reducere conveniat, & omnium minime cubitum*; "That it is not proper to reduce any luxation while "the fever continues, and above all not to reduce "that of the cubitus." But a fever is both a sign and attendant of a violent inflammation, which ac-

[m] De Articulis, Charter. Tom. XII. pag. 445.
[n] De Fracturis, Charter. Tom. XII. pag. 267.

companies

companies a luxation. The ſame is alſo the advice of Celſus [o], when he ſays, *Quidquid autem loco ſuo motum eſt, ante inflammationem reponendum eſt. Si illa occupavit, dum conquieſcat, laceſſendum non eſt: ubi finita eſt, tentandum eſt in his membris, quæ id patiuntur*; "But "whatever is diſlocated ought to be replaced before "the inflammation appears: but when that has inva- "ded the parts, it ought not to be moleſted till it is "appeaſed; and when it is over, trial may be made "what can be done with the diſlocated limb." In the commentary on § 364, we related a caſe, in which a very bad gangrene followed the reduction of the cubitus, while the parts were in a ſtate of inflammation. In ſuch a caſe therefore the reduction ſhould be poſtponed, and the patient or his friends acquainted with the danger that is threatned by ſuch an attempt; but that the cure may be difficult afterwards, and often not compleat: and this to prevent any reflection on the phyſician or ſurgeon. For though a luxation ought to be reduced as ſoon as poſſible, when nothing forbids; yet obſervations teach us, that we ought not wholly to deſpair, when the joint has been a long time diſplaced. For a luxation of the humerus, accompanied with a violent inflammation, could not be reduced till after the expiration of two months time; but yet a compleat cure was made of ſo inveterate a malady [p]. But what obſtinate ſymptoms follow the extenſion of a joint while it is inflamed, is demonſtrated in ſeveral inſtances by Hildanus [q].

Convulſion and other bad ſymptoms.] That a convulſion ſometimes follows a luxation was ſaid in the commentary on § 364. and this eſpecially from extreme pain and a violent extenſion or diſtortion of the tendons or muſcles. But of what conſequence a convulſion may be, we declared in the commentary on § 233. But it is evident that no attempt can be

[o] Lib. VIII. cap. 11. pag. 544.
[p] La Motte Traité complet de Chirurg. Tom. IV. pag. 354.
[q] Centur. 2. Obſerv. 90. pag. 168.

made to reduce a luxation during convulsions, because the pain would be then violently increased as well as the distraction of all the parts; and therefore the convulsive causes would be thence increased. But the antient physicians were so fearful of convulsions in these cases, that Hippocrates [r], and even Celsus [s] after him, even says, *si quoque, repositio osse, nervi distenduntur, rursus id protinus expellendum est*; "That if a "convulsion follows after the bone is reduced, it "must be immediately displaced again." And Hippocrates in another place [t] seems for this reason to pronounce a luxation of the jaw fatal in those who are subject to cramps, and to be convulsed backwards: for then this luxation cannot be reduced because of the cramp; and if it is not reduced life is in danger, as was said in the commentary on § 364.

If now a violent fever, faintings, hiccups, *&c.* attend over and above the symptoms now enumerated, it is evident, that to reduce a luxation cannot be safely attempted, and that therefore the prognosis must be hard.

The investing parts being thinner or thicker.] It was said before from Hippocrates in the commentary on § 363. that fleshy joints do not so easily slip out, but then they are more difficult to replace when out. Therefore the luxations of those larger joints are the most dangerous, which are encompassed with large muscles, and confined by strong ligaments. For such joints cannot be dislocated but by the greatest violence; whence the most dangerous symptoms often follow. Hence it is that Celsus [u], treating of those luxations which are accompanied with a wound, says, *Hic vero & ingens periculum est, & eo gravius, quo majus membrum est, quove validioribus nervis aut musculis continetur. Ideoque ab humeris, femoribusque,*

[r] De Articulis, Charter. Tom. XII. pag. 445.
[s] Lib. VIII. cap. 25. pag. 557.
[t] Coac. Prænot. nº. 361. Charter. Tom. VIII. pag. 872.
[u] Lib. VIII. cap. 25. pag. 557.

melus

metus mortis eſt; *ac ſi repoſita ſunt oſſa, ſpes nulla eſt*; *non repoſitis tamen, nonnullum periculum eſt*; "But "here the danger is great, and the more as the limb "is larger, and confined by ſtronger ligaments and "muſcles. And therefore in ſuch luxations of the "humerus or femur the patient's life is in danger; "inſomuch that if the bones are replaced there are "no hopes; and if they are not replaced there is alſo "ſome danger." And in treating on a luxation of the thigh, he ſays [w], *Magnum autem femori periculum eſt, ne vel difficulter reponatur, vel repoſitum rurſus excidat, &c. cum ibi valentiſſimi nervi muſculique ſint, ſi ſuum robur habent, vix admittere ut reponantur; ſi non habent, repoſitum non continere*; "But there is great "danger in a luxation of the femur, becauſe it is very "difficult to reduce, or when it is reduced, it may be "again diſplaced, *&c.* and as the tendons and muſcles "are here very ſtrong, they ſcarce admit of being "replaced, provided they have their due ſtrength; "and if they have not their due ſtrength, the redu-"ced bones cannot well be retained in their ſitua-"tions." From hence it is evident, that attention muſt be given to theſe particulars in forming a prognoſis.

A rupture or elongation of the ligaments.] If the confining ligaments of the joint have been ſo much ſtretched as to ſuffer the bone to ſlip out of its ſeat, they may be afterwards contracted and reſtored to their former ſtrength, provided they are not broken; but if they have been quite broke, there is great danger leſt the recent wounded lips ſhould grow to the bones or to the adjacent parts, or leſt the cicatrix of the late wound ſhould render the ligaments leſs flexible; whence the eaſy motion of the joint would be afterwards impeded. Thus, for example, a luxation of the os femoris can ſcarcely be ſuppoſed to ariſe ſuddenly from ſome external violence without breaking the round ligament which ariſes out of the ace-

[w] Lib. VIII. cap. 20. pag. 554.

tabulum,

tabulum, for certain it is, that a luxation may arise from a gradual elongation and weakness of the ligaments from some cause seated in the cavity of the joint itself. Hence the difficulty of cure in this case is evident, for it is very seldom that the contracted ends of the broken ligament grow together again; from hence again the reduced bone may be afterwards more easily displaced. But when the dislocated bones appear through a wound of the integuments, the case is then very difficult, especially if their ligaments are entirely divided, insomuch that Hippocrates [x] despairs of a cure in such luxations: for he says, *Quibus autem cruris ossibus luxatis, & vulnus facientibus, penitus excidunt articuli, qui circa pedem sunt, sive in interiorem, sive in exteriorem partem, tales non sunt reponendi, sed sinendum est, ut ille medicus, cui hoc placet, reponat. Scire enim licet, quod moriatur, si repositi serventur, & paucorum dierum vita fiet. Pauci enim septimum diem excedunt. Convulsio enim occidit*; "But in those luxations of the bones of the leg, in which the articulation is perfectly displaced, and accompanied with a wound near the foot, whether towards the internal or external ankle, these ought not to be reduced, but to be left to the care of the physician who attends; for it is to be observed, that the patient dies if the bones are replaced, or at most they survive but a few days, for not many of them exceed the seventh day, being taken off with convulsions." He observes, that the only hope which then remains is, when the dislocated bones of the joint are not replaced, for then the patient may be preserved, though not without an unsightly lameness remaining during their life-time afterwards. He observes likewise, that there is the same danger when the bones of the arm are dislocated with a wound; and says, that these luxations are the worst when they happen in the bones of strong people; so that if the femur is dislocated at the knee, a reduction of it will

[x] De Articulas, Charter. Tom. XII. pag. 435.

kill

kill the patient ſooner than in other caſes; and if there is no reduction, the danger will be ſtill more imminent than in other caſes[y]. He adviſes to attempt the cure of luxations only in the fingers and toes, when they perforate the ſkin with a wound; but even then not without great caution, becauſe the bones afterwards ſuppurate, whence the phyſician might gain diſcredit; and therefore he ought not to be over-forward in attempting to reduce thoſe luxations. But extraordinary events demonſtrate, that we ought not always to deſpair in theſe caſes, eſpecially if ſuch a luxation is accompanied with a rupture of the ligaments in the lower joints. A very active woman jumped down on her feet from an high tree, which occaſioned a large ecchymoſis in the left leg from the toes to the middle of the thigh; but the right leg, pitching only upon the ankle, was ſo twiſted, that the os tibiæ ſtarted through the integuments to the length of three or four fingers breadth, and alſo ran into the earth; at the ſame time too the fibula was fractured at about the diſtance of two fingers breadth from the joint. The violent contuſion and laceration of the parts occaſioned the expert ſurgeons to conclude that the part muſt be amputated; but as the patient was in the flower of her age, of a ſtrong and healthy habit, and the diſorder ſeated towards the lower part of the limb, therefore a reduction of the fractured and diſlocated bones was attempted: for there was a fair opportunity of waiting to ſee if there might be hopes of a cure, ſince the gangrene, which was here juſtly expected, very ſeldom comes on ſo faſt, but that it may be afterwards ſucceſsfully extirpated. But beyond all expectation the pains were mitigated, and convulſions prevented by uſing the beſt remedies; ſo that by an exfoliation of the divided parts of the tibia and fibula, which had been expoſed to the common air, this woman happily eſcaped from ſo dangerous a malady, inſomuch that ſhe could afterwards walk, and perform

[y] De Articulis, Charter. Tom. XII. pag. 444, 445, 446.

her

her wonted buſineſs, though with a ſtiffneſs remaining in the joint of the foot[z]. It is yet ſufficiently evident how difficult and dangerous luxations are, in which the ligaments are deſtroyed.

The annexed muſcles.] For if very ſtrong muſcles are ſeated about the joint, it cannot be diſlocated but by the moſt violent cauſes, from whence the muſcles are often ſo much diſtracted, that they do not afterwards recover their priſtine ſtrength, or, at leaſt, they receive it but very ſlowly; and therefore there will always remain a deficiency in the motion of the diſlocated joint for the future. Thus, for inſtance, it is known from anatomy, that one of the tendons of the biceps muſcle of the arm ariſes from the upper and outward part of the ſinus in the ſcapula, into which the head of the os humeri is received, and paſſing through the ligamentary capſule, over the head of the bone, it proceeds to the ſinus or groove in that bone, and from thence emerging, it then becomes a fleſhy belly, and unites with the other head of the ſame muſcle. If now the head of the humerus is diſlocated forwards, it is very evident that this tendon of the biceps will ſuffer a great diſtention, whence the motion of the joint will perhaps remain for the future in ſome meaſure diſturbed.

Having thus pointed out the principal ſources from whence the prognoſis of luxations may be deduced, it now remains for us to treat of their cure.

SECT. CCCLXVII.

IN order to which is required, 1. a reduction of the diſlocated bones, and 2. a retention of the replaced bones in their proper ſituations, in order to compleat the cure.

[z] De la Motte Traité complet de Chirurgie, Tom. IV. pag. 435, &c.

If

If every thing be duly considered, and it appears that there are no symptoms which can render a reduction of the bones either useless or impossible, it must be then attempted. We observed before, that it was impracticable to reduce luxations which are of long standing, because generally the cavity of the joint is usually filled with concreted juices, or a luxuriancy of the parts freed from the pressure of the dislocated bone. We also observed, that a cure could not be attempted, while the parts were invaded with inflammation, large tumour, or convulsions; as also when we perceive that these symptoms will soon after follow, for then prudence requires to defer the cure; in order to which, the two following particulars are necessary.

1. This is self evident.

2. The ligaments which connect the bones to each other, give the joints their chief strength, but no luxation can happen, without these ligaments are either broken, or so much elongated, that they suffer the head of the bone to be displaced. But it was said before, in the commentary on § 363. that a violent distention may so weaken the solid parts of the body, as to make them lose much of their strength, so that if the bones are replaced, the ligaments do not then acquire their former strength, and therefore easily permit the joint to be dislocated again, unless that is prevented by art. But how easily a joint may be again dislocated after a reduction has been made, we are taught by the case related by the surgeon which we have so often recommended. For he [a] ingenuously confesses, that he could neither prevent the elevation of the patient's arm, nor the dislocation of the bone the second time, when he attempted to reduce the luxated humerus; and yet he reduced the bone again so speedily, that neither the patient, nor the servants who assisted him, could perceive his error. The cure of a luxation

[a] De la Motte Traité complet de Chirurgie, Tom. IV. pag. 347, there-

therefore requires a retention of the reduced bones in their proper ſituations, until the ligaments have recovered their due ſtrength, ſo as to be able to perform their uſual motions without danger of being diſlocated again; for this is the main end of the cure. But the time required for the ligaments to recover their former ſtrength again, is not very exactly limited by authors: in the mean time it is certain, that more or leſs time is required according to the different magnitude of the luxation, and of the joint, and according to the different temperature of the patient, and more or leſs urgency of the ſymptoms which accompany the luxation. The magnitude of the luxation is meaſured by the diſtance of the diſplaced bone from its cavity, as we obſerved before under the preceding aphoriſm; and it is very evident, that the ligaments muſt ſuffer a greater violence, in proportion as the head of the bone is farther diſplaced from its natural cavity: whence a longer time will alſo be neceſſary to compleat the cure. Add to this, that the greater or leſs weight which the limb is to ſuſtain when in health, will alſo more or leſs protract the cure; thus a luxation of the femur and ancle, require a long time of reſt, as Celſus [b] obſerves; but the joints of the fingers recover their ſtrength in four days time, as Hippocrates [c] tells us. But what a difference, in this reſpect, is made by the different conſtitution of the patient, Celſus [d] again informs us, when he ſays: *Si corpus tenue, ſi humidum eſt, ſi nervi infirmi, expeditius os reponitur; ſed & multo facilius excidit, & minus fideliter continetur. Quæ contraria his ſunt, melius continent: ſed id, quod expulſum eſt, difficulter admittunt*; "If the body is thin and moiſt, "and the ligaments are weak, the bone is more "ſpeedily reduced; but then it more eaſily ſlips out "again, and cannot be ſo ſecurely retained. Where- "as in thoſe patients who are of a contrary diſpoſi-

[b] Lib. VIII. cap. 20, & 22. pag. 555, 556.
[c] De Articulis in fine. Charter. Tom. XII. pag. 467.
[d] A. Corn. Celſ. Med. Lib. VIII. cap. 11. pag. 544.

"tion,

" tion, the bones are more ſecurely retained, but " more difficultly reduced." The like we alſo meet with in Hippocrates[e]. It is evident enough, that the number and violence of the ſymptoms often prolong the cure; but yet Hippocrates obſerves, that a ſlight inflammation following the reduction, is rather ſerviceable than prejudicial; ſince the pain then prevents the uſe of the limb, and the ligaments being kept in a ſtate of tenſion by the inflammation, retain the bone more ſecurely in its cavity. Thus he ſays[f], in the place before cited, which we likewiſe mentioned upon another occaſion § 224. numb. 3. *Qui repoſito articulo, partibus ambientibus nulla inflammatione affectis, protinus humero uti ſine dolore poſſunt, hi nulla cura ſibi opus eſſe arbitrantur. Sed Medici officium eſt præſagire contra illorum opinionem, ſi quidem his rurſus prolabitur magis, quam quorum nervi inflammatione tentantur*; " Thoſe who have the joint reduced, without any in- " flammation of the circumjacent parts, are capable " of uſing their arm immediately without pain, and " think that they have no occaſion for any farther aſ- " ſiſtance: but it is the buſineſs of the phyſician to " declare againſt their opinion, in as much as they " will be more liable to a ſecond diſlocation than thoſe " whoſe ligaments are inflamed." It can never be hurtful to ſecure the parts of the diſlocated limb, ſo that it may not be moved for a conſiderable time, provided that care is alſo taken not to let the joint grow ſtiff by too long a reſt.

At the ſame time alſo in the cure, the moſt troubleſome ſymptoms muſt be relieved by a proper diet, and ſuitable remedies, which may likewiſe prevent future ſymptoms, the chief of which are pain, inflammation, and all the bad conſequences that may from thence follow. But of theſe we treated before, and ſhall in part conſider them hereafter. But it is very apparent, that the more numerous and grievous ſymptoms are to be expected, as the diſlocated limb is

[e] De Articulis, Textu 27, 28. Charter. Tom. XII. pag. 306, 307. [f] Ibidem textu 29. pag. 308.

larger, ſince ſuch a limb cannot be diſlocated, but by the moſt violent cauſes, and will alſo require an extenſion proportionably ſtrong to make the reduction. Hence Hippocrates [g] obſerves, that in the reduction of all joints, the patient muſt be enjoined to ſtrict abſtinence, eſpecially where the articulation is very large, and the reduction difficult; but that abſtinence is leſs neceſſary when the articulation is ſmall, and eaſily replaced.

SECT. CCCLXVIII.

THE reduction is performed, 1. by holding the patient's body firm; 2. by moving the limb ſo, that the bone may directly correſpond to its cavity; 3. by introducing it into the cavity by puſhing, turning, and ſtriking it.

1. As more or leſs extenſion is required to reduce a luxation, it is evident that it cannot be performed without pain, by the reaſons before mentioned, § 349, numb. 2. It is therefore neceſſary ſo to ſecure the patient, that he may not diſturb the operator, and it is likewiſe neceſſary to prevent his whole body from moving, when the affected part is extended.

2. Galen [h] prudently adviſes, in treating of the cure of luxations in general, that it is neceſſary to replace or return the diſlocated bone the ſame way in which it was diſplaced. Therefore the conſideration of the expulſive cauſes which have preceded in every luxation, will be neceſſary, in order to return the bone from whence it was diſplaced: and then he illuſtrates the aſſertion by an inſtance of the humerus being diſlocated forward. But how uſeful this admonition will be towards a happy reduction of diſlocated bones, is ſufficiently evident; for the bone which

[g] De Articulis Textu 27, 28. Charter. Tom. XII. pag. 466.
[h] Comment. 1. in Hippoc. de Art. Char. Tom. XII. pag 204.

has

has receded from its natural place, makes itself a way by removing the adjacent parts, and may therefore more easily return by the way which it has already made, than by any other: and this more especially, if the bone is displaced by breaking the ligaments of the articulation; for in that case, if the bone is not directly moved to the same part, it cannot return into its natural situation. In order to perform this, an extension is necessary to be made more or less strong in proportion as the dislocated joint is smaller or larger; which extension is also necessary to prevent any of the adjacent parts from being intercepted, while the head of the bone is reducing to its proper seat. A sufficient extension may be generally made by the hands in luxations of the smaller joints; or in young and lax habits of body, even the same method may be sufficient for the larger joints; but if a stronger force is required, it will be often necessary to make use of slings and machines. A great many beautiful observations are to be found in Hippocrates's book De Articulis, concerning these machines, to which the moderns have added others; see also what has been said of them in the commentaries on § 349.

3. When the dislocated limb is once properly extended and directed, so as to correspond to its cavity, the remainder is then easily performed. Whence Hippocrates [a] treating of a luxation of the femur inwards, says: *Si bene extensum fuerit, femoris caput e regione pristinæ suæ sedis attolletur; cumque sic sublatum fuerit, non facile prohiberi poterit, quominus in suam sedem revertatur; sic ut quævis impulsio & directio sufficiat. Sed deficiunt in extensione, idcirco majorem molestiam habet repositio*; "If the femur is rightly extended, its head will be drawn directly over-against its pristine or natural seat, and in this disposition it will not be easy to prevent it from slipping directly into its proper cavity or seat, to do which

[a] De Articulis, Charter. Tom. XII. pag. 456.

" almoſt any thruſt or direction will then ſuffice. But " if the aſſiſtants are defective in their extenſion, the " reduction will be on that account the more diffi- " cult." For the elaſticity of the ligaments, and ſtrength of the muſcles are frequently in that caſe ſufficient to return the diſlocated bone into its proper ſituation. But a knowledge of the ſtructure of the diſlocated joint will readily acquaint a ſkilful ſurgeon what is further neceſſary to be done, if the bone does not ſlip into its ſeat, after it has been reduced near to its cavity by a due extenſion; for then a gentle twiſting, a ſtroke, or a thruſt, will be frequently ſufficient to replace the bone, while the extenſion is made by experienced ſurgeons. Thus Celſus [b], in treating on the reduction of the lower jaw, ſays, after having obſerved in what manner the patient ought to be placed and ſecured: *Ubi vehementer maxilla apprehenſa eſt, ſi una parte procidit, concutiendum mentum, & ad guttur adducendum eſt: tunc ſimul & caput adprehendendum, &, excitato mento, maxilla in ſuam ſedem compellenda, & os ejus comprimendum eſt, ſic ut omnia pene uno momento fiant*; " When the " jaw is taken hold of firmly, being diſlocated on " one ſide, the chin is to be ſtruck with a blow, and " directed back towards the throat: at the ſame time " alſo the head is to be held faſt, and by agitating " the chin, the lower jaw is to be forced into its " ſeat, preſſing upon that bone in ſuch manner, as " to perform almoſt the whole operation in a mi- " nute." When ſurgeons endeavour to reduce a luxation of the humerus, by ſuſpending the patient with his arm over a door, a ladder, *&c.* making a violent extenſion, the arm hanging downwards, the diſlocated joint then frequently returns to its ſituation in a moment. But how much it is for the ſurgeon's intereſt and ſucceſs in the cure, to be aſſiſted with ſkilful hands, eſpecially in difficult caſes, is ſufficiently apparent.

[b] Lib. VIII. cap. 12. pag. 546.

That

That the diſlocated bone is returned into its former ſituation, is generally perceived by the ſound or noiſe which it makes in the moment of its reduction: but Celſus [c] obſerves, *Quod caput humeri impulſum in ſuam ſedem, modo cum ſono, modo ſine hoc, compellatur*; "That the head of the humerus may be puſhed in- "to its ſeat, as well without a noiſe as with." But almoſt all ſurgeons have obſerved, that there is conſtantly at leaſt ſomething of an obſcure noiſe to be heard at the time of the reduction. Fabricius ab Aquapendente [d] ſeems to have been much alarmed with danger from this noiſe, imagining it to proceed from the colliſion of the head of the bone againſt the edge of its cavity, whence this laſt might be broke before the head of the bone could enter in the ſaid cavity; and therefore he thought a compleat reduction to be impracticable: he likewiſe judged the noiſe to ariſe ſometimes from the percuſſion of the head of the bone againſt its cavity or ſocket, from whence the worſt ſymptoms might be afterwards feared. But daily experience, and the obſervations of the moſt faithful ſurgeons, ſufficiently convince us, that this fear is without any foundation, ſince the noiſe is generally perceptible, and that without being followed by any of the bad conſequences which might be juſtly expected from thoſe cauſes. It was ſaid before, in the commentary on § 365. that a diſtortion or alteration in the figure of the limb, is to be reckoned among the principal diagnoſtic ſigns of a luxation, if joined with the tumour in ſome other part. When the diſlocated bones are properly reduced, it is evident that all theſe muſt again diſappear. It is likewiſe obſervable, that pain always accompanies a recent luxation, from the violent diſtraction of the ligaments, and other adjacent parts; but ſo ſoon as the joint is reduced, that pain immediately ceaſes, or at leaſt is much diminiſhed: for ſometimes a ſmall de-

[c] Lib. VIII. cap. 15. pag. 549.

[d] Chirurg. Univerſ. lib. V. cap. 1. pag. 350.

gree of pain may continue from the violent extenſion, which the circumjacent parts and ligaments of the bones have ſuffered in the reduction, though ever ſo well made; ſince alſo a very ſtrong extenſion is often required, before the reduction can be made.

SECT. CCCLXIX.

AFTER the bones are reduced to their proper ſituations, they are to be retained there by reſt, bandages, and a natural diſpoſition or poſture of the parts.

After the bones have been reduced to their proper ſituations from whence they were diſplaced, then the other part of the cure (§ 337. numb. 2.) ſtill remains; namely, to retain them in that ſituation, but this is performed

By reſt.] In every diſlocation the confining ligaments of the joint have been either broke, or very much elongated; ſo that if reſt is not ordered, the replaced bone may eaſily ſlip out again. It was demonſtrated before in § 25. numb. 3. that the ſolid parts of the body, may be weakened by too great a diſtraction, and in § 28. numb. 5. it was affirmed, that the ſtrength or coheſion of the ſolids is increaſed by the long continuance of all the parts in the ſame contact, which is ſometimes carried ſo far, that they at length acquire too much ſtrength or ſtiffneſs: Reſt will be therefore always neceſſary to reſtore the ſtrength of the over ſtrained ligaments, or to procure an union of them if they are broken; but care muſt be taken not to let the ligaments become rigid by too long a reſt, nor to give occaſion for an anchyloſis to be formed by an accumulation of the mucilage of the joint, which may become inſpiſſated for want of motion. Hence it is adviſeable to gently move, and rub the joint for ſome days after it has

been diſlocated, provided all the pains are abated, and there is no danger of an inflammation, as Hippocrates [a] carefully obſerves, in treating of the cure of a luxation in the humerus. But Celſus [b] remarks, that this caution ought more eſpecially to be obſerved in a diſlocation of the elbow, when he ſays; *Celerius tantum ſæpiuſque id reſolvendum eſt, multoque magis aqua calida fovendum, & diutius ex oleo & nitro ac ſale perfricandum. In cubito enim celerius, quam in ullo alio articulo, ſive extra remanſit, ſive intus revertit, callus circumdatur; iſque, ſi per quietem increvit, flexus illius poſtea prohibet*; "The dreſſings are to be ſpeedily and often removed, the part is to be well fomented with warm water, and to be rubbed for a conſiderable time with oil, ſalt, and nitre. For a callus is ſooner formed in the cubitus than in any other joint, whether it remains diſplaced or reduced to its proper ſituation. And if it ſhould by reſt concrete, the flexibility of the joint will be afterwards deſtroyed."

Beſides this, the pain or inflammation, which often continues from the violence offered to the injured parts, alſo requires the limb to be kept at reſt for ſome time after the reduction.

By bandages.] Unleſs the ligaments are quite broke, or violently ſtretched, the reduced bone may be eaſily retained in its ſituation, barely by keeping the part at reſt: ſo that bandages are not always neceſſary. Agreeable to this, we are told by a very ſkilful ſurgeon [c], that he applied no bandages after a reduction of the lower jaw, and yet the cure ſucceeded very well. But if there is any danger of a relapſe in the diſlocated joint, it may be beſt to ſecure the part with bandages; eſpecially if the preſſure of the compreſſes and other dreſſings is determined by the bandages moſtly to the affected part from

[a] De Articulis, textu 30. 31. Charter. Tom. XII. pag. 308.
[b] Lib. VIII. cap. 16. pag. 551.
[c] De la Motte Traité complet de Chirurgie, Tom. IV. pag. 335.

whence the bone was displaced. This has been very well observed by Hippocrates [d], in treating of a luxation of the humerus, where he says: *His ergo mederi oportet cerato & spleniis, & multas fascias circumdare: supponere autem axillæ lanam mollem puram convolutam, quæ cavum (axillæ) repleat, ut vinculum fulciat, & articulum sustineat*; "These luxations ought "therefore to be secured by plaisters, compresses, and "the application of many bandages: but in the ax-"illa is to be fixed a piece of woollen cloth rolled "up, sufficient to fill the cavity of the armpit, in "order to sustain the joint and fill out the bandage." For by this means the head of the bone may be prevented from slipping out again from its seat into the cavity of the axilla, which, Hippocrates [e] says, is the only manner in which the humerus can be luxated, as far as he could ever observe; and therefore he has not treated of the other species of this luxation.

But it is very evident, that by knowing which way the bone has been displaced from its cavity, it may be prevented from slipping out again by the application of a bandage suitable to each particular luxation. But when the part has been thus secured by bandage, it should be seldom opened, unless an inflammation should attend; for then the apparatus of dressings are to be more frequently removed in all luxations, according to the direction of Hippocrates [f].

The natural posture of the part.] It is evident the part affected must be kept at rest a considerable time; but that it may be so retained without uneasiness, it will be necessary to place it in the same posture in which we observe the limbs when a person is sleeping, and when none of the muscles are acting, by the influence of the will: but at that time the flexor muscles of the limb do by their contraction prevail over the

[d] De Articulis, textu 29. Charter. Tom. XII. pag. 308.
[e] Ibid. textu 3. pag. 290.
[f] Ibid. pag. 466, 467. in fine libri.

extensor

extenſor muſcles; from whence it is that we obſerve almoſt all the joints a little inflected. See what has been ſaid concerning the natural ſituation of the parts in the commentary on § 349. numb. 3. Therefore Hippocrates [g] lays it down as a general rule in every luxation, *Semper quieſcere læſum articulum convenit, & quam optime figurari*; "That it will be always pro-"per to keep the injured joint at reſt, and in the "moſt convenient poſture." And hence he deſcribes the particular poſture moſt convenient for each luxation. Thus, for example, in treating of a luxation of the cubitus, he ſays [h], that the part ought to be ſo diſpoſed in the cure, that the extremity of the hand may be a little higher than the cubitus, while the arm is placed by the ſide of the body; for by that means it may be ſuſpended and carried without any uneaſineſs, and it will be likewiſe more commodious for uſe, and agreeable to nature.

All theſe particulars being duly obſerved, we may reaſonably expect an happy cure when the bone has been diſlocated by ſome external violence; but when the bone has ſlipped out of its cavity from a relaxation of its ligaments, the cure then will be much more difficult; whence Celſus [i] pronounces, *Qui nervorum vitio prolapſi ſunt, compulſi quoque in ſuas ſedes iterum excidunt*; "Thoſe joints, which are diſlocated "through a defect in their ligaments, ſlip out again, "even after they have been reduced to their proper "ſituations." The reduction of theſe luxations is indeed very eaſy, but the retention of them is very difficult, and even ſometimes quite impracticable. All the hope then in this caſe depends upon a long continued reſt of the part, with the application of ſtrengthening fomentations, which may reſtore the relaxed ligaments to their due firmneſs. Petit [k] has obſerved happy ſucceſs in theſe caſes from the application of

[g] De Articulis, Textu 29. Charter. Tom. XII. pag. 467.
[h] Ibid. pag. 331. [i] Lib. VIII. cap. 11. pag. 544.
[k] Acad. des Sciences l'an. 1722. Mem. pag. 163.

thick compreſſes dipt in aromatized ſpirit of wine, and ſpread with a mixture of powdered allum with the white of an egg ſecured all round the articulation of the femur by a convenient bandage; and he frequently applied the ſame medicine to moiſten the bandages and compreſſes without removing the apparatus. Galen tells us [1], that he has twice cured a luxation of the femur proceeding from a relaxation of the ligaments; but affirms, that the articulation ought to be inveſted for a conſiderable time with drying medicines, in order to remove the redundant humidity of the ligaments. Even Hippocrates acknowledges ſo much difficulty in the cure of theſe luxations, that he has recourſe to the laſt refuge of the art, namely to fire or cauterization. For he obſerved that many were by this accident rendered incapable of war and other exerciſes, nor did he ever know any one who rightly treated them, and therefore he is the more large in his deſcription for this method of cure. But he ſpeaks principally of that ſpecies of luxation, in which the head of the humerus ſlips into the axilla; though it is alſo very evident, that the ſame method of cure is likewiſe applicable to other luxations, both of the ſame and of other joints.

The whole deſign of the cure ſeems to conſiſt in forming a cicatrix by the actual cautery in the ſkin and panniculus adipoſus, whence the integuments are ſo much hardened as not eaſily to admit of being extended, ſo as to prevent the bone from ſlipping out again the ſame way. He orders the arm to be a little elevated, (for if it is not raiſed one cannot have free acceſs to the axilla; and if it is raiſed too much, the ſkin will be drawn ſo tight that it cannot be conveniently taken hold of) and the looſe ſkin with the panniculus adipoſus to be pulled out by the fingers, ſo that the integuments may recede a good way from the glands, large nerves, and conſiderable blood-veſſels which are there ſeated.

[1] Comment. IV. in Hippocrat. de artic. Charter. Tom. XII. pag. 453.

He

He then orders the elevated ſkin to be very ſpeedily perforated with an actual cautery, which is not thick but rather long and round; and he would have the iron to be ſo far heated as to be white or pellucid (χρὴ δὲ διαφάνεσι καίειν): then the ſkin being as yet elevated is to have a ſlender ſpatula (ὑπάλειπτρον) paſſed thro' the two apertures made by the cautery, which being done the ſkin is to be let looſe, and another perforation made by a ſlender cautery forced through the integuments till it meets with the ſubjacent ſpatula. Thus the part may be cauterized in three diſtinct places without danger of injuring the ſubjacent parts. Now during the time of the cure the eſchars will be ſeparated, and then the integuments will unite or grow to each other, but in ſuch a manner, that they will be rough and hard with the ſcars occaſioned by the loſs of ſubſtance made by the cauteries: and therefore he adviſes not to raiſe the arm much during the whole time of the cure, but only to elevate it ſo much as will be neceſſary for dreſſing the wounds; for thus the integuments not being diſtended will give an opportunity for the lips of the wounds to cohere and unite with each other the more firmly and ſtrictly. Even after the cure of the wounds, Hippocrates would have the arm tied down to the ſide for a conſiderable time, that the cicatrices may be rendered more firm and ſecure, and that ſpace contracted where the humerus uſed to prolapſe. Hippocrates has alſo pointed out two other places where cauterization may be ſerviceable in this caſe; namely on each ſide the head of the os humeri, betwixt the bone and the large tendons which form the cavity of the axilla on each ſide; namely the tendons of the pectoral muſcle and latiſſimus dorſi [m].

In like manner I remember the cure of ruptures was attempted formerly by a certain empiric, who,

[m] Hippocrat. de Articulis, Textu 41, &c. Charter. Tom. XII. pag. 312—320.

after

after returning the prolapſed inteſtines, deeply cauterized the integuments of the rupture, either with the actual or potential cautery; and this with a view, that they, being contracted with a deep cicatrix, might not ſo eaſily yield afterwards to any extenſion.

Of Inflammation.

SECT. CCCLXX.

An inflammation, which is ſometimes called a phlegmon or fire, is ſo denominated from the ſimilitude both of its cauſes and effects with thoſe of fire.

Before we proceed to treat of acute diſeaſes, it is beſt to premiſe the hiſtory of inflammation with all its conſequences, becauſe that will afford much light into the nature of thoſe diſeaſes; and the ſucceſſive changes made by an inflammation in the external parts of the body towards health or another diſeaſe, may be more diſtinctly underſtood; and from thence one may foreſee what will follow when the like diſorder invades the internal parts of the body.

General cuſtom has in all languages (as far as I can find) impoſed a name to this diſorder from that of fire. Thus it is termed *inflammatio* by the Latins, and *phlegmon* or *phlogoſis* by the Greeks. Nor need we wonder at this, ſince the greater heat, which was ever aſcribed by all people to an inflammation, is proved from phyſics to ariſe from a greater quantity of fire. Thus ſays Galen[a]; *Hic vero tumor, aſſumens pulſum & igneum ardorem, antea proprie vocatam phlegmonen perficit. Non autem ſic veteres; ſed quemcunque ardorem vocabant phlegmonen, uti ſæpius vobis demon-*

[a] Comment. 3. in Lib. Hippocrat. de Fracturis. Charter. Tom. XII. pag. 236.

ſtratum

ſtratum fuit. Verum ab Eraſiſtrati temporibus ſolitum fuit, phlegmones nomen dici de illis tumoribus, in quibus non tantum eſt calor inflammans, ſed & renixus & pulſus: ex neceſſitate vero habent & ſic vocatum ruborem, &c. " But this tumor, aſſuming a pulſation and fiery " heat, anſwers then properly to the ancient title of " phlegmon. But the ancients do not thus diſtin- " guiſh it; for they called any heat or inflammation " a phlegmon, as I have frequently demonſtrated. " But from the time of Eraſiſtratus it has been cuſto- " mary to term theſe tumors phlegmons, in which " there is not only an inflammatory heat, but alſo a " reſiſtance and pulſation; they have alſo of neceſſi- " ty a redneſs ſo called," *&c.* And in like manner in another place [b] he mentions heat among the diagnoſtic ſigns of a phlegmon. And thus Ægineta [c] ſays, *Communiter quidem calidos omnes & dolentes cum ardore tumores phlegmonas vocare conſueverunt. Pro diverſitate vero materiæ, efficientis ipſos, horum quoque differentiam variare dicunt. Sanguine namque bono & moderatæ craſſitiei in partem aliquam confertim irruente, & ob copiam impacto, proprie dictam Phlegmonem fieri; bile flava autem in quadam parte hærente, Herpeta; ſanguine vero cum bile flava irruente, Eryſipelas. Quando vero ſanguis influens calidus admodum fuerit & craſſus, carbones parere ſolet*; " That indeed it was uſual to call " all hot tumors, accompanied with pain and burning " heat, by the name of phlegmons. But that even " theſe are ſaid to differ according to their efficient " matter. For good blood of a moderate conſiſtence " flowing plentifully and forcibly into any part, be- " ing there impacted by its quantity, occaſions the " Phlegmon properly ſo called; but yellow bile lodg- " ing in any part forms an Herpes; and blood flow- " ing together with yellow bile cauſes an Eryſipelas.

[b] De Tumoribus præter Naturam, cap. 2. Charter. Tom. VII. pag. 313.

[c] Lib. IV. cap. 17. pag. 63. verſa.

" But

" But when the influent blood is very hot and thick, " it uſually produces carbuncles."

Heat was therefore a common ſign of every inflammation among the ancients, who gave the common appellation of phlegmon to all kinds of inflammation; but they afterwards reſtrained it only to that ſpecies of inflammation, in which there was a reſiſting tumor, accompanied with a redneſs, and a burning heat; but to the other ſpecies of inflammation they gave different names. Thus in Celſus [d] we read, *Notæ inflammationis ſunt quatuor, rubor, & tumor, cum calore & dolore*; " That the ſigns of inflammation " are four; to wit, a redneſs, and tumor, with heat, " and pain." Whence it appears, that the general name of inflammation was even among the Latins reſtrained to only one particular ſpecies.

But that there is a greater quantity of fire in the inflamed part is demonſtrated by thermometers, and the effects being quite ſimilar to thoſe which ariſe from the application of elemental fire to the body. For when a healthy perſon applies the back of his hand to a fire, he begins to perceive a greater heat, then the part will become red; and if he applies it ſtill nearer to the fire, it will ſwell and become painful; but if he continues to approach with his hand ſtill nearer to the fire, the pain will be violently increaſed, the cuticle will be raiſed into bliſters, and at length the ſkin itſelf will be burnt up into an eſchar by the increaſed action of the fire; which eſchar being abſolutely a dead or foreign ſubſtance, muſt be ſeparated from the living parts by a ſuppuration: but the ill conſequences of an inflammation are altogether the ſame with theſe, and ariſe in the like order. For a ſlight heat, redneſs, and tumor, attended with pain, form an inflammation on the back of the hand; all which ſymptoms have increaſed in proportion to the diſorder itſelf. But from a violent inflammation tending to a gangrene, the cuticle is alſo raiſed into bliſ-

[d] Lib. III. cap. 10. pag. 139.

ters,

ters, and gangrenous eſchars are formed, which muſt be likewiſe ſeparated from the living parts by ſuppuration: and if the inflammation ſtill continues increaſing in violence, all the parts appear black even to the bone, in the ſame manner as if they were burnt by the fire; and then the part is ſaid to be mortified or ſphacelated. Hence alſo Hippocrates calls an ardent fever by the name of fire, (τὸ πῦρ) becauſe in that diſorder there is often ſo great a heat felt in the vital organs, as if there was a real fire; from whence death often enſues very ſuddenly. And in the moſt ardent fever, the plague, when the malignity of the diſtemper is tranſlated to ſome particular part of the body, it is obſerved to be burnt up in ſuch a manner, as if it was actually occaſioned by fire; as is evident in the peſtilential carbuncles, which are afterwards ſeparated and thrown off by a ſuppuration all round them; and this perfectly in the ſame manner as is uſual when any part of the body has been burnt by a red hot iron. Thus the wiſe ancients did, by obſervation only of the effects of an inflammation, denominate it juſtly from fire; ſince both the cauſes and effects of each are alike: and the modern obſervations concerning the nature of fire are a ſtrong confirmation of all that has been here ſaid.

SECT. CCCLXXI.

AND it conſiſts in a greater preſſure and attrition of the red arterial blood, ſtagnating in the ſmalleſt veſſels, and urged by the motion of the reſt of the blood, which is more forcibly agitated by a fever.

In this aphoriſm we are furniſhed with a definition of an inflammation or phlegmon, properly ſo called from its cauſes, and denominated ſo by the ancients from its ſymptoms. For they defined a phlegmon, (as

(as is evident from what we lately cited from Galen under the preceding aphorism,) that it is a preternatural tumor, hard and resisting, with redness, heat, and a pricking pain, accompanied generally with a fever. But it must be observed, that this definition here given relates only to the inflammation so far as it extends to those vessels, which naturally contain red blood, or which at least may by dilatation admit the blood. But as for what relates to this disorder, when it is seated in the most slender or lymphatic vessels, we shall treat hereafter at § 379, 380. This being premised, we may be able to explain the definition above given.

In this disorder there are two concurring causes, which together constitute the nature or existence of inflammation; namely obstruction, with an increased velocity of the blood flowing into the obstructed vessels. For the blood stagnates in an inflammation, and cannot pass through the smallest vessels, even though it be urged forward by the impulse of the succeeding blood; there is therefore an obstruction of the vessels denying a passage to the humours which they ought to transmit. But it is evident from what has been said on § 107. that an obstruction is formed whenever this passage or transmission of the humours through the vessels is cut off. The obstructing matter is the red blood of the arteries; because it is in the arteries only, that an obstruction, properly speaking, can take place, as we demonstrated in the commentary on § 119. But the parts of the vessels obstructed are their smallest branches and extremities, since it is evident, that the obstructing particles may be as yet able to pass through the larger vessels; but then they will be stopped towards the ends of the smaller converging vessels. But we do not here understand the smallest vessels of all in the body, but only the smallest branches of the largest; those namely which contain the grossest part of the humours, the red blood. So that these vessels may be called the

the ſmalleſt with reſpect to the largeſt of their own genus, but with reſpect to thoſe which are ſtill ſmaller, even theſe may be termed large: for the ultimate ends of the ſanguiferous arteries will be always larger than the ſerous artery which thence ariſes, and which by the ſmallneſs of its diameter naturally excludes all the red blood. Thus it alſo is in the laſt extremities of the ſerous arteries, which will for the ſame reaſon be always larger than the lymphatic artery thence ariſing, &c. Hence it is evident, that a true phlegmon is almoſt conſtantly ſeated in the ſmalleſt ſanguiferous arteries, or elſe in the ſerous arteries dilated; and therefore this is the inflammation of the firſt order, as we termed it at § 122. But when the obſtructing particles ſtagnate at the ends of the ſmaller veſſels, they will be neceſſarily compreſſed by the action of the vital humours behind; and this even with no ſmall force, ſince it is by the force of the heart and arteries that the blood flows into the obſtructed part with ſuch a velocity or impetus, as would be ſufficient to convey it through the extreme parts of the body, with a conſiderable degree of its velocity ſtill remaining; whence the preſſure muſt be great, and renewed at every contraction of the heart and arteries. (See the commentary on § 120.) But as the obſtructing particles ſeem to remain immoveable, wedged into the extremities of the ſmaller veſſels, it does not ſo readily appear from whence the attrition muſt ariſe, which ſeems to ſuppoſe the influx and return of theſe particles. But if what has been ſaid in the commentary on § 132. numb. 1. be duly conſidered, the obſtructing particles will appear to be not always immoveable or at reſt, but ſometimes repelled by the contraction of the arteries towards their larger diameter, and then again propelled forward by the force of the heart filling the arteries, and urging the blood into their ſmalleſt extremities; and from hence it is that a real attrition is here produced.

All

All that has been hitherto ſaid is alſo applicable to obſtructions in the ſmalleſt veſſels formed by a ſtagnation of the red arterial blood, and therefore it is added in the definition *more forcibly agitated by a fever*. When a violent inflammation has invaded any of the viſcera or more conſiderable parts of the body, we then always find it accompanied with a fever; but if the inflammation is ſeated in the ſmaller parts of the body, eſpecially the external, it may be then queſtioned whether a fever is always preſent; for an inflammation of the eyes, an inflammatory quinſy, *&c.* are frequently obſerved without any ſenſible alteration in the pulſe. This is very well explained by Galen [a], where he deſcribes the nature of pulſes which accompany inflammation; *Incipiente enim inflammatione pulſus major eſt, quam ſecundum naturam, & vehementior, & celerior, & crebrior. Aucta inflammatione omnia hæc increſcunt, & manifeſte durior fit, &c.* "For at the beginning of the inflammation the "pulſe is larger, ſtronger, ſwifter, and more frequent "than according to nature. But when the inflamma- "tion is increaſed, the pulſe is alſo increaſed in theſe "reſpects, and becomes manifeſtly harder," *&c.* And a little afterwards he adds, *Hæc inflammatio habet, quæ pulſum per totum corpus immutat, ſive ob magnitudinem, ſive ob principem partem, in qua conſiſtit. Si vero univerſum corpus non afficiat, pulſus in parte inflammata talis erit, qualem diximus*; "This inflamma- "tion has ſomething in it which changes the pulſe "throughout the whole body, either from the mag- "nitude of it, or the importance of the part, in "which the inflammation is ſeated: but if the whole "body is not affected, the pulſe will be found thus (as "we before deſcribed it) in the inflamed part itſelf." It is therefore under this reſtriction, that we are to underſtand the aſſertion that a fever is a general companion with every inflammation, at leaſt in the

[a] De Pulſibus ad Tyrones, cap. XII. Charter. Tom. VIII. pag. 8, 9.

inflamed

inflamed part, if not in the whole body; since the strength and quickness of the pulse will be there increased, so as to occasion as it were a fever of the part itself, as Galen [b] very well observes in another place. For after saying that there are a great many different sorts of inflammations, he observes, that a fever usually accompanies all of them. He then places the principal difference of inflammations in their being dry or moist: *Humida quidem, quæ ex calida fluxione partem obsidente fit: sicca autem, quando sine ulla fluxione connatum calorem accendi contingit. Hoc autem quodammodo velut febris partis ipsius est*; "That "the moist inflammation is indeed that which is "formed by a hot defluxion invading the part: but "the dry inflammation happens when the heat endeavours to inflame without any defluxion; and this "is in a manner a fever of the part itself." It is also a firm opinion of the ancient physicians, that an inflammation is always accompanied with an increased motion: for Celsus [c] in his preface, where he relates the different sects and opinions of physicians, has the following passage: *Si sanguis in eas venas, quæ spiritui accommodatæ sunt, transfunditur, et inflammationem, quam Græci* φλεγμονὴν *nominant, excitat, eaque inflammatio talem motum efficit, qualis in febre est, ut Erasistrato placuit*; "If blood is forced into those vessels, "which are destined for lymph or spirits, it occasions "that inflammation which the Greeks call a phlegmon, which inflammation has the same motion as "in a fever, according to the opinion of Erasistratus." Here we are to observe, that he does not say simply that a fever arises whenever there is an inflammation, but only that there is the same motion attending an inflammation as attends a fever.

Hence we have a very salutary admonition proposed in the practice of physick by Dr. Simson [d], that

[b] De Meth. Med. ad Glaucon. Lib. II. cap. Charter Tom. X. pag. 367. [c] pag. 5. [d] The System of the Womb, &c. by Thomas Simson, pag. 106, 107.

the phyſician may not be deceived by imagining there is no inflammation when there is no fever. For there are often fixed pains which cauſe an inflammation of the ſtomach and inteſtines, even when no fever can be obſerved by an examination of the pulſe: and he even aſſerts, that he has ſeen baſtard pleuriſies epidemical which would have afflicted the patient for ſeveral months without any fever, unleſs they had been treated immediately with bleeding and other remedies proper to abate inflammation.

From what has been ſaid it is alſo evident, that obſtruction has many things in common with inflammation, but that no inflammation can be conceived without an obſtruction alſo attending: beſides which, we demonſtrated in the commentary on § 120. that a violent obſtruction increaſes the velocity of thoſe juices which are to paſs through the pervious veſſels; that is, it occaſions a fever. But ſo ſoon as a fever accompanies the obſtruction, there is then an inflammation; which may be therefore termed an obſtruction with a fever, either in the whole, or only in ſome particular part of the body.

SECT. CCCLXXII.

WHICH diſorder may therefore take place, either in the extremities of the ſanguiferous, ſerous, lymphatic, or other leſſer arteries, whoſe mouths being dilated admit the red globules, or the groſs particles of ſome other fluid, incapable of paſſing through their extremities. If blood is transfuſed into thoſe veſſels, which are deſtined to lymph or ſpirits, it excites an inflammation, ſays Celſus, pag. 5.

It is therefore evident from the definition given in the preceding aphoriſm, that an inflammation or phlegmon, properly ſo called, can take place only in thoſe

thoſe veſſels which naturally contain red blood; or elſe in thoſe veſſels, whoſe orifices are ſo dilated by diſeaſe, that they admit the red part of the blood. For the particles of a fluid thinner than the red blood, being concreted from any cauſe in the other ſmaller veſſels, may alſo occaſion an obſtruction in them; and the fluid, preſſing behind the obſtructed particles may alſo occaſion a greater velocity in thoſe veſſels, without producing any redneſs in the affected part; and then the diſorder is not termed a phlegmon, but an eryſipelas or œdema callidum, *etc.* as we ſhall explain it at § 379, 380. But how far the red part of the blood may penetrate, and into what number of the decreaſing ſeries of veſſels it may enter, when their orifices are preternaturally dilated, cannot as yet be determined by experiment. In the mean time it is evident, that the red blood may not only enter by diſeaſe into the ſerous veſſels, which naturally contain yellow ſerum, as being the next coloured fluid in groſſneſs to that of the red blood; but it may alſo enter veſſels which are ſtill much ſmaller and which naturally contain only a pellucid lymph. The white of the eye, which reſembles the brightneſs of a pearl in healthy people, becomes often ſo red by an inflammation, that one may perceive the innumerable ramifications of the veſſels, which being diſtended with red blood, are viſible enough to the naked eye; when in their natural ſtate they contained only a colourleſs fluid. I have even ſometimes obſerved, in the worſt ſpecies of the ophthalmia, that there has been a veſſel full of red blood paſſing through the very pellucid ſubſtance of the tunica cornea, conſpicuous even to the naked eye; but there is no one can doubt, but that the veſſels of the cornea, are much ſmaller than thoſe of the adnata; ſince in an healthy ſtate they are pellucid, as well as their contents. And a violent inflammation there ariſing often occaſions a red circle, viſible for a conſiderable time around the edge of the cornea, from a diſtention of the veſſels with red

blood, while there is no defect as yet apparent in the cornea itself; but at length the small vessels of the cornea being gradually dilated, by the violence and continuance of the disease, they may also admit the red part of the blood. From hence it is evident, that a true phlegmon or sanguine inflammation may sometimes take place even in very minute vessels.

As to the passage quoted in this aphorism from Celsus, which we mentioned before on another account under the preceding aphorism; we are assured that the most antient physicians comprehended by the name of veins, as well those vessels which we now call arteries, as those which are properly called veins. It was the opinion of Erasistratus and many of his followers, that the pulsatil veins which we now call arteies, did not contain blood, but air or spirit, which occasioned the pulsation in those vessels. There were even a great many of his sect in the time of Galen who boldly maintained this assertion, and even promised to demonstrate that the aorta itself did not contain any blood; but Galen [a] justly laughs at them, and evidently demonstrates by experiments the falsity of their assertion.

So that if we interpret this passage of Celsus by the opinion of Erasistratus, he must have supposed an inflammation to arise from the blood passing out of the veins into the arteries, which were judged to be naturally void of blood; that is an hesitation of the blood in other vessels. But we, being at present acquainted with the circulation of the blood, know better; though even their assertion may be countenanced in one sense; since an inflammation in reality arises, when the blood passes out of its proper vessels into those which naturally contain more subtle juices.

See more upon this head in the commentaries on § 122, where we treated of the different kinds of in-

[a] De Anatom. Administ. Lib. VII. cap. 16. Charter. Tom. IV. pag. 164, &c.

flammation,

flammation, as arising from the different diameters of the several series of decreasing vessels.

SECT. CCCLXXIII.

THE seat therefore of this disorder may be every part of the body, in which there are reticular distributions of sanguiferous and lymphatic arteries.

After Ruysch discovered by his injections, that in almost all parts of the body, the arteries were divided and distributed into the most minute branches, and that the small branches arising from larger branches communicated with each other, and with the adjacent small branches; it has from that time been customary with physicians to denominate these distributions of arteries, net-works (*reticulæ*) or reticular plexuses, because there are small spaces left betwixt the branches, which unite together in the manner of a net. During the many years which that anatomist diligently prosecuted his injections, he often found (as we may perceive in many parts of his works) that there were intermediate spaces left betwixt the reticular plexuses, which seemed to be destitute of vessels; but by a more successful repletion, he afterwards demonstrated innumerable vessels even there distributed, almost in the same order as he before observed in the larger branches. But wherever the arteries are found to divide into the smallest branches, there the particles of the blood or lymph may hesitate, being rendered impervious by concretion, or some alteration of their figure; or even from a diminution of the diameters of those small vessels, by which they are rendered less capacious, the free passage of those juices which ought naturally to flow through them, may be again impeded; and from

hence we have an obſtruction, which with an increas'd motion of the juices, (*a tergo*) behind, produces an inflammation. Now, as in almoſt all parts of the body there are ſmall branches derived from the ſanguiferous arteries, which by their minuteneſs exclude the red part of the blood, it is evident, that by a dilatation of the mouths of thoſe veſſels the red parts of the blood may miſtake their courſe, and enter the ſmaller veſſels; in the narroweſt parts of which they will ſtop and become impervious: from whence again all the like inflammatory ſymptoms may ariſe.

SECT. CCCLXXIV.

HENCE the ſeat of an inflammation may be as well ſeated in the arteries themſelves, as in the veins, nerves, membranes, muſcles, glands, bones, cartilages, and tendons, with all the viſcera; and therefore throughout almoſt every part of the body, but in no part more frequently and violently than in the fat.

Since it is evident from the modern anatomy that almoſt every part of the body contains veſſels which are capable of being demonſtrated to the eye; it is therefore apparent, that an inflammation may ariſe almoſt throughout the whole body, and eſpecially in thoſe parts which are enumerated in this aphoriſm.

Arteries and veins.] The coats of theſe veſſels are compoſed of other ſmaller veſſels, as is demonſtrable to the eye by injections, in their larger trunks. And even in animals which have been killed after a long hunting or courſing, the whole external ſuperficies of the aorta has been often obſerved to be almoſt black, from the too great diſtention of thoſe ſmall veſſels with blood, which are by an admirable intertexture diſtributed through the coats of this largeſt veſſel.

veſſel. We alſo treated of this in the commentary on § 123. numb. 2. where we enumerated a tumour of the ſmaller veſſels, ſpent in the coats of the larger, among thoſe cauſes which diminiſh the capacity of the larger veſſels.

Nerves.] The nerves may be conſidered two ways, either as they are compoſed of a tender production of the medulla of the brain, cerebellum and ſpinal marrow, or, as they are compoſed of tough membranes, or caſes furniſhed with all ſorts of veſſels. (See the comment on § 181.) in which membranous caſes, the very ſoft and pulp-like ſubſtance of the encephalon and ſpinal medulla is ſafely conveyed to all parts of the body. But whether or no thoſe extremely minute veſſels, which eſcape all our ſenſes, and compoſe the ſubſtance of the nerve properly ſo called, are at any time inflamed, is not ſo evident: but as a very thin fluid paſſes through them from the brain, cerebellum, and ſpinal medulla, as we obſerved in the commentary on § 181. it therefore ſeems reaſonable, that a diſorder of the like nature may alſo take place in theſe moſt minute veſſels. But it is evident enough, that a true inflammation may take place in thoſe larger veſſels, which are demonſtrated to the eye by anatomical injections, diſtributed throughout the conſtituent coats of the nerves.

Membranes.] For we at this time know by anatomical injections, that the moſt ſolid membranes, which the antients imagined to be altogether bloodleſs, are little more than mere intertextures of veſſels.

Muſcles and tendons.] It is evident from injections, that an infinite number of arteries are every way diſperſed through the fleſh or body of the muſcle; and we alſo know, that even the tendons, which appear ſo very white and compact of themſelves, do by anatomical injections become quite red, not only from a repletion of thoſe veſſels which are ſpent in the capſules inveſting the tendons, but alſo of thoſe veſſels which are in the ſame manner diſperſed, and run in

great numbers betwixt the fibres of the tendon itself. From whence it is evident, that an inflammation may be likewise here seated; and in a violent rheumatism the muscles are often so much inflamed, that the most excruciating pains arise even from the slightest endeavour to contract them.

Glands.] Whether they be mere convolutions or bundles of vessels, or only hollow cells discharging their contained juices by emissaries, after they have been secerned from the innumerable small vessels which creep upon the membrane of each cell; for the thing will be quite the same in both: for in both cases the fabric of the gland is asserted to be composed of an infinite number of small arteries; whence it is evident, that in these an inflammation may arise, as we are assured by daily observation in the parotid, submaxillary, axillary, inguinal, and other glands.

Bones.] I believe it was sufficiently proved in the commentaries on § 249, 252, 253. in the history of wounds of the head, that vessels are conveyed from the periosteum into the substance of the bone, and pass betwixt its lamellæ; and that others enter through particular small holes to the diploe of the cranium, and which in other bones extend to the medulla; and hence the separation of the corrupted part, and the reproduction of what is lost, is ascribed to the efficacy of those vessels themselves which are dispersed through the substance of the bone. Therefore an inflammation may arise in this solid part, either in the arteries which run betwixt the bony lamellæ, or in the vessels of the medulla itself, from whence arise most obstinate and deep pains, a spina ventosa, *etc.* as we shall hereafter explain, when we come to treat on the diseases of the bones. Even Galen [a] has formerly observed, that the bones are sometimes liable to inflammation; for after saying that the coats of the vessels, with the membranes, tendons, and nerves may

[a] De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 315.

be

be inflammed, he adds: *Quamobrem ossa quoque nonnunquam inflammatio attingit, uti et ex ipsis primo affectis aliquando prorumpit* (ἐρμᾶται.) "Wherefore an inflammation does also sometimes penetrate into the "bones; and sometimes it is extended from the "bones, when they are first affected." From what preceded the passage we have now cited, it is evident, that Galen intends that an inflammation of the incumbent parts may extend not only into the bones, but also that an inflammation first formed in the bones may be sometimes extended from them to the other circumjacent parts.

Cartilages.] The cartilages come next in structure to that of the bones, and many of them are in time converted into bones, as is apparent from osteogeny. But as we find a vascular structure in those bones which were once cartilages, it seems very probable, that the like structure existed before in those cartilages: and besides this, the diligence of anatomists has discovered and demonstrated vessels in the cartilages. Thus Dr. Havers [b] affirms, that he has observed a hundred pores in the thyroide cartilage, which admit vessels from the perichondrium into the substance of the cartilage, and other pores which transmit the returning vessels. By a happy injection of young bodies, Ruysch [c] has observed blood vessels to penetrate through the body of the patella, and to pass in great numbers into its meditullium. And in another place [d] he confirms this, in saying that he can demonstrate to the eye, that there are real blood vessels distributed within the cartilages themselves; and that he discovered them even in the cartilaginous superficies of the head of the os femoris, and in the margins of the moveable cartilages which are placed in the articulation of the knee, betwixt the ends of the bones. But as these vessels proceed from the con-

[b] De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 282. [c] Adversar. Anat. Dec. 2. pag. 3. [d] Ibid. Dec. 3. pag. 33.

tiguous

tiguous bone into the cartilage, he was surprized that they extended only to about the length of two lines, and never emerged into the outer surface of the cartilage. From hence therefore it is evident, that an inflammation may take place as well in the cartilages as in the bones.

All the viscera, and therefore almost throughout every part of the body.] That the viscera are composed of vessels wonderfully complicated or disposed, and in a different manner in each particular viscus, we are acquainted from the modern art of injection; and the acute diseases of the viscera, which we shall hereafter consider, will evidently show, that an inflammation with all its consequences, a suppuration, gangrene, scirrhus, *etc.* are sometimes observed in these; and this not without excepting the heart itself, notwithstanding Pliny will have it to be the only viscus which does not waste by disease, nor draw any assistance from life, but being injured, causes instant death, as we observed in the commentary on § 304. For the pulpy substance of the heart being suppurated in a woman, she discharged a purulent matter for many days by urine, and when she was dead, four months after upon opening her body, an abscess, and some small stones were found in the heart, as Hollerius [e] testifies. From hence it is justly concluded, that almost every part of the body is liable to inflammation, since it is demonstrated from the modern anatomy, that almost every part of it is vascular.

But is in no part more frequent and obstinate than in the fat.] We are well assured that the cellular membrane extends almost into every part of the body, and acquires different denominations, according to the different matter which it contains. For if it contains a white and hard fat in its cells, not fusible without heat, it is then called tunica adiposa; but when the matter contained in this membrane is soft and oily, it is then termed pinguedinosa. But in those parts of

[e] In Commentariis in Coac. Hippoc. pag. 824.

the

the body where this membrane is thinneſt, its cells being empty of oil or fat, eſcapes the eye, and is termed ſimply celluloſa; as, for inſtance, in the back of the hand, the forehead, *etc.* But how far this membrane extends itſelf throughout the human body, will appear, if we conſider, that not only all the muſcles and tendons are inveſted with ſuch a cellular membrane, but that even every muſcular fibre, as far as the eye and patient hand of the moſt acute and dextrous anatomiſt has been able to penetrate, is alſo inveſted with the like cellular membrane. Almoſt every veſſel in the body runs in or through ſuch a cellular ſubſtance, which in part conſtitutes the fabric of the veſſels and viſcera themſelves. From whence it is evident, that an inflammation may frequently ariſe in this cellular or adipoſe membrane; and when it is once ſeated in this part, the inflammation uſually proves very ſtubborn; being frequently incapable of a diſcuſſion, and tends either to a ſuppuration or a gangrene. Now as the arteries which are diſperſed through this membrane, do uſually in their natural ſtate ſecern a fat oil or unctuous liniment, ſerving to lubricate the parts, for which uſe it is depoſited in the cells of this membrane, it would therefore ſeem, that theſe veſſels being dilated or broke by an inflammation, will occaſion the red part of the blood itſelf to tranſude and be accumulated in theſe cells; and from hence that hard and red tumor ſeems to ariſe, which accompanies the true phlegmon, whoſe ſeat is almoſt conſtantly in this cellular membrane only. Galen [f] has very well expreſſed this affair, in a ſentence which we quoted before upon another occaſion, in the commentary on § 118. *Quum ſanguis calidus copioſior in aliquam animalis partem procubuit, majora ejus vaſa protinus diſtenduntur, quæ plenitudinem non ferunt; ab his deinceps quæ minora ſunt. Mox ubi nec in iis ſatis continetur, exſudat foras in illa ampla ſpatia, quæ inter vaſa ſunt, ſic ut etiam omnia, quæ in com-*

[f] Method. Med. Lib. X. cap. 6. Charter. Tom. X. pag. 233.

poſita

posita carne habentur, loca occupet; "When the hot "blood flows more plentifully into any part of the "animal, its larger vessels will be immediately dis- "tended, which not being able to support the pleni- "tude, the blood will then flow from them into the "smaller vessels. But soon after this, the small ves- "sels not being sufficient to retain it, the blood will "transude or escape into those large spaces which lie "betwixt the vessels, so as to occupy all of them, "which are in the composition of the flesh." But by flesh Galen here understands the adipose or cellular membrane, as is sufficiently evident from what he writes in the last chapter of the same book. Besides this, it is also confirmed by the event of inflammation, that the seat of it is most frequently in the cellular membrane. For if a violent inflammation be followed with a suppuration or a gangrene, the confined matter or gangrenous ichor is observed, upon perforating the skin, to be lodged always in the cellular membrane. Thus I saw, in a frightful gangrene which extended through the leg from the knee to the ends of the toes, that a large part of the panniculus adiposus came away while the subjacent muscles and tendons were quite sound.

SECT. CCCLXXV.

THIS stagnation (371.) is caused in the smallest arteries, 1. by every thing which contracts or diminishes the conical or cylindrical ends of the small vessels, in such a manner that their diameter or opening, becomes less than the diameter of a blood globule; whether this be done by pressure, distraction, contortion, rupture, contusion, burning, erosion, or shrinking of their membranes. To these add, heat, violent motion, foreign bodies in the flesh, ligatures, incumbent weights,

weights, acrid ſubſtances, either taken as food, or applied externally, ſevere cold, too much friction, and all the cauſes of wounds, contuſions, eroſions, fractures, luxations, and obſtructions.

In the definition of an inflammation in § 371. two things were conſidered: namely, a ſtagnation of the red parts of the blood in the ſmalleſt arteries, and a preſſure or attrition from the blood preſſing behind with a greater impetus againſt that which was obſtructed. In this aphoriſm are enumerated thoſe cauſes which occaſion that ſtagnation in the ſmalleſt arteries; which yet, in their natural ſtate, are capable of tranſmitting the red part of the blood through their ſmalleſt extremities.

1. The arteries which convey the red blood, having firſt carried off the thinner parts by their lateral branches for various purpoſes, do then tranſmit the red globules (which are of a ſize too large to enter the ſmaller veſſels) from their ſmalleſt extremities into the veins, with which they form a continued veſſel. Therefore where one of theſe ſmaller arteries terminates, there the vein begins; now the artery, in its courſe, always diminiſhes gradually from a larger capacity to a leſs; but the veins are the ſmalleſt at their origin, and gradually enlarge through their whole courſe. Hence the humours paſs in the arteries from the baſis of the cone to the apex; but in the veins they paſs from the vertex towards the baſis of the cone. But in thoſe parts where the artery becomes ſmalleſt, and forms itſelf into the continued ſmalleſt veins, there the veſſel ſeems to be cylindrical, at leaſt for a ſmall ſpace, the ſides neither converging nor diverging: and if the cylindrical veſſel proceeds, either towards the artery or towards the vein, it then aſſumes the figure of an erect or an inverſed cone. But in this part where the ſanguiferous artery terminates, and the ſmalleſt vein thence ariſing begins, there

there is the ſmalleſt diameter, or the narroweſt part of the veſſel; and therefore the particles of the blood becoming impervious from any cauſe, will ſtagnate in this part. If now we again conſider, that theſe extremities of the veſſels may be contracted many ways, the juices will there ſtagnate, and be incapable of paſſing through theſe narrow anaſtomoſes. And from hence it is alſo evident, why the text contains the terms conical and cylindrical.

It was ſaid before in the commentary on § 115. that the ſmalleſt particles of the circulating humours in animals, viſible by the microſcope, appear ſpherical; and towards the laſt extremities of the veſſels only one globule has been obſerved able to paſs through at a time, and that even with ſome difficulty. From whence it is ſufficiently apparent, that the anaſtomoſes, or ſmalleſt extremities of the veſſels, being contracted or diminiſhed from any cauſe, will obſtruct the free paſſage of the humours, by diminiſhing the capacity of the veſſel; ſince the bulk of the particles to be tranſmitted, does in this caſe exceed the diameters of the orifices through which they are to paſs; and therefore an obſtruction muſt conſequently ariſe, which is always an inſeparable companion of inflammation, as is evident from the definition given of it in § 107.

But ſince (as was ſaid in the commentary on § 109.) every ſection of our veſſels, which is made perpendicular to their axis, is a circle, and as that figure has the greateſt area of any that has equal ſides; it is from thence evident again, that every cauſe, which is able to change the figure of the veſſels, may occaſion a ſtagnation of the humours to be tranſmitted through the laſt extremities of the arteries. But of theſe cauſes the principal are thoſe enumerated in this aphoriſm, many of which have been explained before.

Preſſure, diſtraction, contortion.] Concerning theſe you may conſult what has been ſaid in the commentaries on § 112. numb. 1, 2, 3.

Rupture.]

Rupture.] The orifices of divided veſſels naturally contract and obſtruct the free courſe of the juices, which ought to flow through them, as was demonſtrated in the commentaries on § 158. and 159. numb. 2 and 4. and it is alſo evident from what was there ſaid on numb. 5. that a true inflammation may follow from that cauſe.

Contuſion.] Since the idea of contuſion includes an aſſemblage of ſmall wounds, as was ſaid on § 322. it is therefore evident from thence, why a ſtagnation of the humours is that way occaſioned. Add to this, that a contuſion always reſults from the preſſure of ſome hard and obtuſe body injuring the ſolid parts, which cannot be done without compreſſing or changing the figure of the veſſels.

By burning, eroſion, ſhrinking, *etc.*] For by all theſe ways a part is either totally deſtroyed, as by the action of fire or ſtrong cauſtics, whence the living veſſels in the margin of the diſorder are obſtructed; whence a ſtagnation and inflammation follow: or if the action of theſe cauſes is milder, by a contraction of the ſolids and an inſpiſſation of the fluids, many of the veſſels will be rendered impervious; from whence again the ſame diſorders will ariſe, as we ſhall hereafter explain more at large when we come to treat of burns.

Heat.] That is when the degree of it much exceeds the heat of a perſon in health. But we ſhall hereafter demonſtrate, when we come to treat of an increaſed heat as a ſymptom of fevers, § 689. that the ſolid fibres are therefore dried, contracted, and made rigid; but then the rigidity of the fibres, being increaſed, will augment the contractile power of the veſſels which they compoſe, whence their capacities will be diminiſhed, and an obſtruction thence formed, as was demonſtrated in the commentaries on § 113. If now it be alſo conſidered, that too great heat evaporates the moſt ſubtile parts of the fluids; and that after this the blood and its ſerum concrete

into ſolid maſſes, hardly capable of being again diſſolved; it will be from thence ſufficiently apparent, that an increaſed heat is juſtly reckoned among the cauſes of inflammation.

Violent motion.] Conſult what has been ſaid in the commentaries on § 100. where it was proved, that an obſtruction, inflammation, and all their conſequences, may ariſe barely from an increaſed motion.

Foreign bodies in the fleſh.] When any ſharp pointed body is fixed in the fleſh, it injures the veſſels, and compreſſes thoſe which are adjacent, while at the ſame time it cauſes a continual pain and irritation; from hence it is eaſily apparent, that an inflammation muſt from thence ariſe, eſpecially when it is fixed in parts that are very ſenſible; for then the ſymptoms are ſeldom removed, till the injurious body is diſcharged by a ſuppuration made by nature. Ruyſch [a] gives us a remarkable inſtance of this kind in a girl, who ſwallowed a needle unknown to her parents; after which a hard inflammatory tumour was formed in the groin, accompanied with a violent fever and intenſe pain. This tumour was brought to ſuppuration by the application of emollient cataplaſms, and being opened with a lancet, the needle was diſcharged ruſty, with a conſiderable quantity of matter mixed with ſome of the inteſtinal fœces. This dangerous diſorder was yet happily cured. But there are many obſervations, which teach us, that needles and other ſuch ſharp-pointed bodies may lie dormant for a conſiderable time in the panniculus adipoſus without giving any great uneaſineſs. Thus I knew a turner, who had ſix years before a ſplinter of wood ran into the fleſh betwixt his thumb and fore-finger; where it continued, and might eaſily be felt for ſo long a time without giving any great uneaſineſs or diſturbance to him in his daily labour; and therefore he would never ſuffer it to be extracted by a ſurgeon, who notwithſtanding told him the ill conſequences that might

[a] Obſervat. Anatom. Chirurg. n°. 55.

follow.

follow. I likewiſe ſaw another inſtance which proves the ſame thing. A girl complained of a pricking pain about the arm: after a diligent examination of the part, I could not find any thing amiſs, even by handling it all over; and ſhe particularly obſerved, that the pain did not always trouble her, but only in ſome certain motions. I ordered the application of a galbanum plaiſter, and viſited her again ſome days after: but as ſhe found no relief from thence, in making a ſecond and more diligent examination of the part, I felt ſomething prick my finger, and afterwards perceived the ſharp point of the needle ſticking out through the injured ſkin. I extracted the needle with its thread, which was ſix inches long, by a pair of forceps; and then ſhe preſently recollected, that about ſix weeks before ſhe had loſt that needle while ſhe was intent upon her work.

Ligatures.] Theſe diminiſh the capacity of the veſſels by compreſſion; but they act more upon the veins than the arteries: ſince the former have their coats much weaker; and they likewiſe act more upon thoſe veins which are placed in the ſurface of the body. But when ligatures are drawn very tight, they then compreſs the arteries as well as the veins. This is evident in the daily performance of phlebotomy; where, if the ligature is moderately tight, the blood runs freely from the inciſed vein: but if the ligature is drawn too tight, it compreſſes the artery likewiſe, and therefore little or no blood follows; but when the ſurgeon perceives this, he ſlackens the ligature and by that means promotes the efflux of the blood. See what has been ſaid in the commentary on § 112. numb. 4. where we alſo gave a reaſon, why incumbent weights produce obſtructions by compreſſing the veſſels externally.

Acrid ſubſtances, either taken as food, or applied externally.] It ſeems to be a property of almoſt all parts of our body, whether external or internal, to contract themſelves upon the application of any thing

acrimonious; and there are many experiments which prove the same thing. If a little drop of vinegar is sprinkled into the eye, the eye-lids are so strongly contracted, even against the person's inclination, that they require more than a small force to open them. And acrid poisons, taken into the stomach and intestines, occasion violent contractions in them; from whence, with the confined and heated air, great inflations arise. Upon applying a small drop of oil of vitriol with a probe to the naked intestine of a dog, I observed it immediately contract in the same manner, as if it was constringed by tying a ligature round it. It is therefore probable, that if acrid substances reach to the smaller vessels, they will likewise be brought into the same contractions, from whence follows an obstruction, which, joined with an increased circulation of the blood, may produce an inflammation. Thus when the blood itself is infected with an acid acrimony, it is observed to produce itchings, obstructions, pustules, and little ulcers about the cutaneous vessels, as was said at § 64. When the stagnating serum, which distends the legs of dropsical patients, begins to turn acrid, the skin is often inflamed. But if the force of the acrid substance is so great, especially when externally applied, as to dissolve the continuity of the vessels, it is sufficiently evident, from what has been before said, that then the inflammation may be produced in a much greater degree.

Severe cold.] It is evident from experience, that cold contracts the dimensions of all solid bodies; and therefore it must contract the capacity of the vessels. It was also proved in the commentary on § 117. that the particles of the blood cohere together by cold; and therefore by both these effects, cold may produce an obstruction and inflammation, and that in so great a degree, as to be often followed with a gangrene in a very little time, as we shall declare hereafter at § 454, 455. From hence too the reason may perhaps appear, why a pleurisy so frequently follows, when

when husbandmen indiscreetly expose themselves to the cold air when they return sweating from their labour: for the inspired and cold air comes almost into contact with the intercostal vessels, while only the very thin membrane of the pulmonary vesicles is interposed betwixt them; and at the same time the cold air increases the disorder externally, by being freely admitted to the body, which is not well covered.

Too much friction.] Of what efficacy friction is, in removing obstructions, was said before in the commentary on § 133. numb. 3. But when the friction has been continued too violently or too long a time, it may produce an ardent fever, even in the most cold and dropsical habits, as we explained it before in the commentary on § 28. numb. 2. For the motion or return of the venal blood being thus accelerated, the heart will contract more strongly and frequently, whence an increased motion of the circulation; which being too much increased produces an inflammation, as we demonstrated in the commentary on § 100. Thus we observe, that violent frictions make the parts of our bodies grow hot, red, swelled, and painful; but all these are the true signs of a present phlegmon, which will indeed soon go off if the friction is not continued too long, nor in too violent a degree: for when sailors on board a ship suddenly let the ropes run through their hands to slacken the sails against the wind, if they grasp them too firmly, a most violent attrition, heat, and pain thence arises in a moment, so as to raise the cuticle into blisters like those of a gangrene. If now we also consider, that by frictions the red part of the blood may be drove into many of the smaller vessels, into which it never enters in a natural state, (as is evident from the redness which accompanies almost every friction,) it will be still more evident, how an inflammation may be produced by too much friction.

All the causes of wounds, contusions, *etc.*] Concerning

cerning all these we have sufficiently treated before under those respective disorders.

SECT. CCCLXXVI.

THE same stagnation is also produced, 2. by every thing which occludes the passage of the vessels, and applies an acrimony to them at the same time, whether externally or internally; such as substances which are both oily and saline, acrid, *&c.*

We know for certain, that the whole surface of the body, both external and internal, is perspirable; that is, a very thin vapour is expelled every moment of life through the smallest arterial ducts which open outwards; which vapour being condensed upon the polished surface of a cold looking-glass, or any other metalline body, forms a thin water, which afterwards entirely exhales without leaving any fœces. If now these ducts are by any cause obstructed, as through them the perspirable and very thin vapour ought to be expelled, those very minute vessels will be therefore dilated by the impulse of the confined humour; and being thus dilated, they may admit grosser juices, from whence an obstruction and stagnation consequently follow. But the least exhaling vessels being thus obstructed, those which are next in magnitude to them, not being able to discharge the thinnest part of their fluid into the exhaling vessels as before, they will be also dilated; and thus the disorder will be propagated from the smallest exhaling vessels even to the gross blood-vessels.

But as this exhaling vapour resembles water almost in every respect; and as oil prevents the entrance of water into very minute glass tubes, or at least renders the entrance of it more difficult, this may therefore be the reason why inflammations and an erysipelas so frequently

frequently arise from the external application of oil. Thus we read, that the bodies of the athletæ or champions were anointed with oil, that they might not be too much exhausted by sweat: and after bathing it was customary to use unction, to prevent the moisture from evaporating which had been acquired in the bath, and to prevent the native heat from escaping through the pores, which had been set open by the warm bath [a]. In many people the skin itself is immediately inflamed by the application of a fat or oily unguent or emplaister: and something of the same nature seems to take place in the internal parts, since many people are inflamed or feverish soon after the taking of oily substances, and especially lard. If now these oily or fat substances also contain an acrimony, very obstinate inflammations may thence arise. Oil of almonds, which is so mild or sweet when it has been lately expressed, does by the summer's heat grow rancid in a few days time, and at length acquires so great an acrimony, that it inflames the fauces, though swallowed in but a very small quantity. The same is also true with respect to butter, which becomes rank either by long keeping or by frying in a pan. But an acrimony mixed with an oil or fat is the more prejudicial, because it most firmly adheres to the part to which it is applied, nor can it easily be washed off by watery liquors. The berries of the spurge laurel of the shops, (*Thymelææ lauri folio semper virente fructus,*) being pressed by the fingers, discharge a mere oil, which at first deceives the palate with a mild taste, but soon after it so much inflames the fauces, that when I unwarily tasted it, it almost suffocated me, insomuch that I was not able entirely to remove its troublesome acrimony, even by washing my mouth continually with a mixture of water, vinegar, and honey for the space of two whole hours. Thus also those caustic and empyreumatic oils, which are obtained by an intense fire from hartshorn, lig-

[a] Hier. Mercur. de arte Gymnastica, Lib I. cap 8. pag. 36, 37.

num guaiacum, and the like, (which are often recommended for the cure of ſtiff joints and for diſperſing impacted matter,) being imprudently applied to the ſkin, have been obſerved to occaſion the moſt malignant inflammations, and ſometimes even to produce a gangrene. For in theſe we find the greateſt tenacity of oils, which obſtructs the pores and ſmall veſſels: and this alſo combined with a violent acrimony, by which the irritated veſſels are contracted.

SECT. CCCLXXVII.

3. EVERY thing which cauſes the blood to concrete or cohere together; ſuch as too great motion, a conſumption of the thinner parts of the blood, by ſweats, urine, ſpitting, or a diarrhæa; to which add every thing that coagulates the blood.

It was ſaid in the hiſtory of obſtruction, that it aroſe from the exceſs of the bulk of the tranſient matter above the capacity of the tranſmitting veſſel; and that therefore the general cauſes were too great a narrowneſs of the veſſels, or an increaſe of bulk in the particles of the fluid to be tranſmitted, or laſtly from a combination of thoſe two cauſes acting at one and the ſame time. In the two preceding aphoriſms we conſidered the cauſes producing a ſtagnation in the ſmalleſt ſanguiferous arteries, ſo far as it aroſe from a contraction of the veſſels: but in this place we are to treat of thoſe cauſes which make the blood cohere or run into ſuch groſs particles, that it cannot paſs through the narrow extremities of the ſmaller arteries, even though their diameters or capacities remain the ſame. But among theſe cauſes the principal are,

Too great motion.] In the commentary on § 100 where we treated of the effects which follow from an

increaſed motion or circulation of the blood, as a cauſe, it was demonſtrated that the blood acquired ſuch a diſpoſition by this increaſed motion, as rendered it more apt to concrete. For in the blood there is always a tendency towards concretion, which is the ſtronger, in proportion to the ſtronger action of the veſſels upon their contained blood. For the blood of ſtrong men taken from a vein immediately congeals, and after ſtanding a while at reſt, exhibits much cruor or craſſamentum, and but little ſerum: the contrary of all which we obſerve in the blood of a weak girl. But all this depends on the more or leſs powerful action of the veſſels upon their contained blood. But by an increaſed motion, the action of the veſſels in a given time is more frequently and ſtrongly repeated upon the contained fluids, by which means they acquire a greater condenſation or compactneſs. Beſides this by an increaſed motion the moſt fluid parts are diſſipated; becauſe a greater quantity of blood is applied in a given time to the organs which from thence ſeparate and diſcharge the thinner juices: and from hence again the tendency of the blood to concretion will be augmented. Add to this, that an increaſed motion is followed by an increaſe of heat; from whence likewiſe the blood may be ſo inſpiſſated, that it can be no longer able to paſs through the narrow extremities of the ſmaller arteries. And therefore in acute diſeaſes, when the heat is much increaſed, the injured function of the brain and the difficulty of reſpiration, immediately denote that there is ſuch an inſpiſſation of the blood that it can no longer paſs freely through the narroweſt paſſages of the ſmaller arteries in theſe viſcera.

A conſumption of the thinner parts of the blood by ſweats.] We are taught by obſervation (as we mentioned before in the commentary on § 93.) that the groſſeſt particles in the human blood are the red globules; but that there are a great many ſorts of thinner juices interpoſed, by which the mutual contact and

coheſion of the larger globules to each other, are impeded. So ſoon, therefore, as this more thin and fluid part of the blood is drawn off by any cauſe, the larger globules will then come into contact, and being moſt ſtrongly preſſed together at the ends of the ſmaller arteries, they will there combine or concrete; from whence a ſtagnation of them, and an obſtruction of the veſſels follow. Thus when night ſweats begin to waſte a conſumptive patient, the impervious blood begins to heſitate in the ſmall veſſels of the ſkin, and occaſions inflammatory puſtules. And for this reaſon it is that Hippocrates condemns ſweats in the beginning of acute diſeaſes: and Sydenham has obſerved their pernicious conſequence when the patient has profuſe ſweats in the beginning of the ſmall-pox.

Urine.] In hyſterical and hypochondriacal diſorders, there is often an incredible quantity of urine diſcharged, almoſt as thin as water, eſpecially when the mind has been diſturbed by any violent affection; but the blood being thus deprived of its diluting vehicle, its groſſer parts begin to concrete, and ſometimes occaſions very malignant inflammations; or elſe the craſſamentum of the blood is depoſited about the abdominal viſcera, where it uſually produces the moſt obſtinate obſtructions. And from hence ſo often ariſes thoſe hyſterical or hypochondriacal paſſions, which are aſcribed to the atra bilis.

Spitting.] If we examine the ſaliva which naturally flows from the mouth of a perſon in health, it appears ſufficiently thin, (for the mucus of the fauces and adjacent parts being mixed with the ſaliva by the motion of the tongue, renders it more tenacious;) and by chemical analyſis it appears to conſiſt almoſt intirely of water; for out of ſixty ounces of ſaliva, there may be almoſt fifty nine ounces drawn over by a gentle fire, which reſemble water in all reſpects. The ſaliva alſo does not concrete with the heat of boiling water; from whence it appears to be thinner than the ſerum of the blood. A copious diſcharge by

ſpit-

ſpitting will therefore drain off a great part of the thinner juices in the body, which the blood being deprived of, is by that means rendered leſs pervious or fluid. And for this reaſon, thoſe who by an ill cuſtom, or an abuſe of tobacco, daily throw away large quantities of their ſaliva, are ſo frequently afflicted with the worſt kinds of obſtructions in their abdominal viſcera. After all the internal parts of the mouth have been a long time covered with thick aphthæ, when they fall off, an incredible quantity of ſaliva is diſcharged from the dilated veſſels: inſomuch that if the immoderate flux or ſpitting is not removed by proper remedies, the patient is often exhauſted and killed, or elſe afflicted with chronical diſeaſes for a long time afterwards; becauſe the blood being thus deprived of its more fluid parts, produces incorrigible obſtructions; nor is it any objection againſt us, that the blood does not become inſpiſſated by a continual diſcharge of ſaliva in great quantities, continued often for ſeveral weeks together in a mercurial ſalivation: for in this caſe there is not a diſcharge of the ſaliva properly ſo called, but all the humours of the body, being diſſolved into a putrid water by the action of the mercury, are this way evacuated: ſo that in this caſe the blood is not deprived of its moſt fluid parts, while the groſſer parts are left behind; but even the red part of the blood itſelf undergoes a true diſſolution; and therefore the patient may very well ſupport this diſcharge, if the freſh juices of good aliments continually ſupply the place of the diſcharged humours.

Diarrhœas.] For this way likewiſe the thinner parts of the blood may be diſcharged from the body, as is ſufficiently evident. Therefore Hippocrates in his Prænotiones Coacæ, pronounces a profuſe diarrhœa to be fatal in an ardent fever: for ſince in this diſeaſe the blood begins to be impervious in the ſmaller arteries, by diſcharging the thinner parts of the juices, in a flux the diſorder will be rendered incurable.

Which

Which coagulate.] Concerning these you may consult what has been said in the commentary on § 117.

SECT. CCCLXXVIII.

THE like disorder is occasioned in the lymphatic arteries, 1. by all causes which dilate their orifices wide enough to admit the grosser parts of the blood, which being drove further into these vessels, are stopped against their converging sides, and then the same consequences follow here as we explained before in § 377. that is, there will be dilatation of the vessel towards its origin, and a violent motion of the arterial humour behind the obstruction. 2. by all the causes which are commonly productive of other inflammations (375, 376.)

Hitherto we have considered those causes which obstruct the free course of the gross or red part of the blood through the smallest sanguiferous arteries: which causes acted either by diminishing the capacity of the vessels, or by rendering the blood itself impervious. But besides this, we also observe a true sanguine or red inflammation in those vessels which naturally exclude the red parts of the blood, by the smallness of their diameters. Of this we have a notable instance in the ophthalmia, in which the whole tunica adnata or white of the eye, and even the cornea itself look red, by a distention of their small vessels with the red part of the blood, to such a degree that they become visible to the naked eye, whereas naturally there was no red blood contained in those vessels. Such an inflammation must therefore have been preceded by certain causes, which put these dilated vessels in a condition to receive the red parts of

of the blood. Now it is evident, that the red parts of the blood being once entered into these smaller vessels, must produce an obstruction; since it will continually stop against the narrower sides of these converging vessels; from whence an obstruction arises, even 'tho' the capacity of the vessel remains the same, and the particles of the fluid which ought to be transmitted are not at all augmented. And this disorder is properly enough termed an obstruction (*per errorem loci*) by the blood mistaking its course; since in this case the red part of the blood stagnates, having entered the smaller pellucid vessels, and not being capable of passing through their smallest extremities; so that the whole essence of the disorder consists in the red blood escaping into other vessels. See concerning this what has been said in the commentary on § 118, where it was also proved, that this disorder may take place in every part of the body, in which there are vessels carrying a fluid thinner than the blood derived from the sanguiferous arteries. This disorder therefore, or error of place, can never be seated in the blood vessels, since we never observed any particles in healthy blood of a larger magnitude than that of the red globules; but it may take place in the several series of the other decreasing vessels. But how far this red part of the blood may penetrate into those vessels, is not as yet ascertained by experiment; but this we know, that in many diseases it often passes into vessels which are much smaller than those which contain the serum of the blood; as will appear evidently enough, if we consider, that it sometimes enters even the small vessels of the tunica cornea of the eye. But since all that fluid which is thinner than the red and serous globules of the blood, is generally denominated lymph; therefore those vessels through which the thinner fluid passes, are also termed lymphatics; and these are either arteries or veins. But it was proved in the commentary on § 119. that an obstruction cannot be seated in the veins, unless the course

courſe of their fluids is intercepted by an external compreſſion; and therefore the groſſer particles of the blood can form obſtructions by an error of place in the lymphatic arteries only; under which name we include all arteries which admit fluids whoſe particles are ſmaller than thoſe of the red and ſerous globules of the blood, refuſing entrance to theſe laſt.

Therefore in order to form this diſorder by an error of place, it is required for the mouths of the lymphatick arteries to be ſo far dilated that they may admit the red part of the blood. But it was demonſtrated in the commentary on § 26. that the amplitude or capacity of the veſſels depended on two different cauſes; namely, the reſiſtance of their ſides, and the momentum or force of the impelled fluid; and that therefore it was to be eſtimated in a ratio compounded of the impulſe of the fluid directly, and of the reſiſtance of their ſides inverſly. If therefore a greater laxity ſhould from any cauſe ariſe in the beginning of the lymphatic arteries, the force of the impelled fluid remaining the ſame, they will be dilated; and on the other hand, the impulſe of the fluids being increaſed, while the reſiſtance of the ſides of thoſe veſſels remains the ſame, it will produce the like effect; but this more eſpecially when both theſe cauſes concur at the ſame time. See what has been ſaid concerning the laxity of the veſſels, as a cauſe of the blood's miſtaking its courſe, in the commentary on § 118. But why the orifices of the veſſels are dilated by an increaſed motion of the arterial fluid, was explained in the commentary on § 100. But what has been now ſaid, is alſo confirmed by experiments; for any part of the body being expoſed to the vapours of warm water, will ſwell and look redder than uſual, from the ingreſs of the red blood into the ſmaller relaxed veſſels. And after violent running, we ſee that the whole external ſkin looks red, and the eyes are in a manner ſuffuſed with blood from the entrance of that fluid into the ſmaller pellucid

pellucid veſſels, which are dilated by the greater impulſe communicated to the fluids.

2. When once the red blood is entered into a lymphatic veſſel, it is evident enough, that all thoſe cauſes which are capable of diminiſhing the capacity of the larger or ſanguiferous arteries, may produce the ſame effects, when applied to theſe ſmaller arteries. But of theſe we treated in the two aphoriſms here cited.

SECT. CCCLXXIX.

HENCE we ſee that the ſame diſorder may take place in every conical veſſel, in which the humours flow from a larger to a leſs capacity; for as in the red blood, ſo in the lymph; there are probably many parts groſſer than the reſt.

In healthy blood, which has been lately drawn from a ſmall wound, and viewed by a microſcope in capillary glaſs tubes, we diſtinguiſh ſeveral ſorts of particles; and the ſame we are likewiſe able to diſcern in the pellucid membranes of living animals, in which the circulation of the humours through the veſſels may be ſeen. For here we perceive globules ſwimming in a thinner pellucid fluid, in which laſt we can diſcover nothing farther, becauſe the pellucidity makes the fluid appear homogeneous. But it ſeems highly probable, that in the thin or pellucid lymph of the blood, there are alſo ſome parts groſſer than others, which by their determinate magnitudes, are contained in proportionable veſſels, into ſmaller than which they cannot naturally enter. For unleſs the red globules were ſo large as to prevent them (in an healthy ſtate) from entering the ſerous and ſmaller veſſels; it is evident that all the blood would be derived into the ſmaller veſſels, while the larger veſſels

veſſels would remain quite empty. The ſame is alſo true in thoſe veſſels which convey the ſerum of the blood, and in the ſeveral ſeries of the ſmaller veſſels. From hence when the blood becomes too fluid in diſeaſes, it is either exhaled, or diſcharged out of the body by the emunctories, or is accumulated in the larger or ſmaller cavities of the body, as we obſerve in dropſies; but then the larger veſſels always collapſe for want of a ſufficient quantity of the thicker part of the blood which uſed to diſtend them. Now the ſame thing ſeems to be true in the other decreaſing ſeries of the veſſels, from the largeſt ſanguiferous, down to the moſt minute exhaling ones; that is to ſay, every ſeries of veſſels have their proper and reſpective fluids, which are compoſed of ſuch groſs particles, that they cannot enter into the ſmaller veſſels of the next ſucceeding order, but are confined each to their reſpective veſſels. This being premiſed, if the capacity of theſe converging veſſels is by any cauſe diminiſhed, or the particles combined, which uſed to paſs through the narrow extremities of thoſe veſſels, an inflammation may follow; but not a red one, as being ſeated in the ſmalleſt and pellucid veſſels. Add to this, that if the orifices of the ſmall veſſels of the next ſucceeding order, are by a relaxation, or too violent a motion, ſo dilated as to admit the groſſer particles of the next larger ſeries of veſſels, it muſt produce the like ſpecies of diſorder (*ab errore loci*) by miſtaking their place. There may be therefore as many different kinds of inflammations as there are different ſeries of veſſels, interpoſed betwixt thoſe which are the largeſt and the ſmalleſt in the body; and they may be there produced two ways, either from a narrowneſs of the veſſels, and an impervioufneſs of the fluids, from the largeneſs of their particles or elſe by an error of place, when the groſſer particles paſs out of the larger veſſels into the dilated orifices of the ſmaller veſſels. But in the largeſt or ſanguiferous veſſels,

an

an inflammation can never be produced by an error of place, since there are no particles found in the blood grosser than those of the red globules. Whether or no the rheumatism, and gout of the joints and feet, arise from an inflammation of the smaller vessels, is a question concerning which you may consult what has been said in the commentary on § 122.

SECT. CCCLXXX.

FROM hence the true difference betwixt a phlegmon, erysipelas, œdema, and a scirrhus with an inflammation, is sufficiently apparent.

Phlegmon.] Though the antients used this name for any kind of inflammation, yet it was afterwards customary (as we said in the commentary on § 370. from the authority of Galen and Ægineta) to apply this term only to a preternatural tumour accompanied with redness, resistance, heat, pulsation, and pain in some soft part, with a fever attending either in the whole body, or in the part itself. But this is occasioned from a stagnation of the red blood about the extremities of the arteries, whilst the rest of the blood acts with a greater impulse from the force of the heart and arteries, urging it forward behind the obstructions. A phlegmon may therefore arise either in the smallest extremities of the sanguiferous arteries, or, which is more frequent, it may be produced by an infarction of the red blood into the serous or lymphatic arteries by an error of place. But it is evident by what has been said in the commentary on § 371. that the seat of a true phlegmon is most frequently in the adipose membrane.

Erysipelas.]

Eryſipelas.] Galen [c] defines an eryſipelas in ſuch a manner, that it would ſeem entirely to reſemble a true phlegmon; for he ſays, *Si ex ſanguine et flava bile juſto calidioribus fluxio miſta fuerit, aut ex ſanguine quidem, ſed fervido, et ſubſtantia tenuiſſimo, eryſipelas vocatur ille affectus, multo calidior inflammatione, et aſpectu flavior. Et ſi tetigeris, ſanguis facile ſubfugit, rurſuſque affluit, exquiſite tenuis et ruber apparens. Non tamen ſimiliter dolet eryſipelas ac inflammatio: neque ſecundum ullam inflammationis ſpeciem aut pulſum, aut compreſſionem, aut diſtenſionem ſimilem adfert. Verum aliquando moderate omnino infeſtat, et maxime, quando circa ſolam cutim diſperſum eſt, minime lædens ſubjectam carnem. Et plerumque tale fit, et illud eſt exquiſitum eryſipelas*; "If a fluxion or congeſtion ariſes from a "mixture of blood and yellow bile hotter than uſual, "or even from hot blood alone much attenuated, the "diſorder is termed an eryſipelas; which has a much "greater heat than an inflammation, and a yellower "aſpect. If you touch or preſs it, the blood readily "diſappears, and again returns, appearing very thin "and florid. But yet an eryſipelas is not ſo painful "as an inflammation, nor is it like any kind of in-"flammation accompanied with a pulſation, reſiſt-"ance, or diſtention. Even ſometimes it appears "very moderate, and eſpecially when it is ſpread on-"ly about the ſkin, without at all injuring the ſub-"jacent fleſh; as it moſt generally does, and is then "a true eryſipelas." And a little after he adds, *Exquiſitum eryſipelas ſolius cutis affectus eſt*; "That a "true eryſipelas is a diſorder of the ſkin only." But as the part invaded with an eryſipelas appeared of a yellowiſh red colour; therefore the antient phyſicians accuſed the bile as the principal cauſe; but we at preſent know that the ſerum of the blood is naturally yellow, ſo that if a little cruor ſtagnates with much ſerum in the pellucid veſſels, which are obſtructed

[c] Lib. II. Meth. Med. ad Glaucon. cap. 1. Charter. Tom. X. pag. 368, 369.

and

and inflamed, the affected part will then appear of a reddiſh yellow colour. Hence alſo appears the affinity which is betwixt an eryſipelas and a phlegmon, ſince they only differ in the magnitude of the obſtructing particles: for in a phlegmon the red part of the blood is accumulated in the obſtructed and diſtended veſſels, but in an eryſipelas, the ſerum of the blood mixed with a little cruor, becomes impervious in the ſame manner: alſo the ſeat of a phlegmon is chiefly in the membrana adipoſa, whereas an eryſipelas invades either the external integuments of the body, or the internal membranous parts. And from hence alſo it appears, that an eryſipelas may degenerate into a phlegmon, from the dilating veſſels admitting a larger quantity of the red blood, and ſpreading the diſorder into the adipoſe membrane: alſo that ſometimes an inflammation may ariſe, as it were betwixt an eryſipelas and a phlegmon, in which caſe the ancient phyſicians termed the diſorder by a name compounded from both of thoſe affections. For ſoon after the paſſage, which we lately cited from Galen, he adds [b], *Quemadmodum id, quod ſubjectam carnem attingit, neque ex tenui omnino fluxione fit; non ſolum eryſipelas eſt, ſed mixtus affectus ex eryſipelate et phlegmone, in quo quandoque propria eryſipelatis ſymptomata prævalent, et à recentioribus medicis vocatur talis affectus eryſipelas phlegmonodes; quandoque autem phlegmones, et dicitur ideo phlegmone eryſipelatodes. Quod ſi neutrius (ſymptomata) evidenter prævalent, ſed æqualia videantur, phlegmonen et eryſipelas miſta eſſe dicuntur*; "That "an inflammation, which extends to the ſubjacent "fleſh, and does not ariſe entirely from the afflux of "a thin humour, is not a ſimple eryſipelas, but a "mixt affection from an eryſipelas and a phlegmon, "in which ſometimes the proper ſymptoms of an "eryſipelas prevails; and then this diſorder is by the "more modern phyſicians called a phlegmonode ery-

[b] Lib II. Meth. Med. ad Glaucon. cap. 1. Charter. Tom. X. pag. 368, 369.

" ſipelas; ſometimes alſo phlegmons prevail, and are " for this reaſon called eryſipelatode phlegmons. But " if the ſymptoms of neither of theſe appear to pre- " vail, but ſeem to be equal, the diſorder is ſaid to be " a phlegmon and eryſipelas mixed."

Œdema.] The word Οἴδημα ſimply ſignified a tumour, as was ſaid in the commentary on § 112. numb. 1. but in proceſs of time this name was underſtood generally to mean a ſoft tumour without pain, and eaſily yielding to the touch without an alteration in the colour of the ſkin, which tumour generally ariſes from watery humours diſtending the cellular membrane. But the œdema of which we here ſpeak is of a very different nature, being generally denominated *œdema callidum* to diſtinguiſh it from the former. It was demonſtrated in the commentary on § 379. that a true inflammation might ariſe in the arterial veſſels, which, by their minuteneſs, exclude the red and ſerous parts of the blood. A tumour therefore, which is painful, hot, and not red, but yellowiſh, or ſometimes even white, is to be called an œdema callidum; which only differs from an eryſipelas, in that the ſeat of the diſorder is placed in much ſmaller veſſels. It is ſometimes alſo called an eryſipelatous œdema, inaſmuch as it often nearly approaches an eryſipelas. It is frequently obſerved in the head and face, and is commonly termed the *gutta roſacea*. Some ſigns of this œdema are to be met with in Galen[c]; for though he aſſerts that any kind of tumour may be called by this name, or rather that it might be more particularly applied to cold tumours properly ſo called, yet in treating on the cure of an eryſipelas, whether ſimple or compounded with other diſorders, he ſays, *Quemadmodum autem ſæpe phlegmonæ admiſcetur Eryſipelas, ita etiam aliquando œdemati: ac vocetur, quod ex ambobus tum eſt conflatum, Eryſipelas œdematoſum*; " But in the ſame manner as a phlegmon is often compounded with an eryſipelas, ſo an eryſipelas

[c] Meth. Med. Lib. XIV. cap. 3, 4. Charter. Tom. X. pag. 321.

" may be ſometimes mixed with an œdema, and may " be denominated, as being compounded of both, " an eryſipelas œdematoſa." But that he did not underſtand the caſe, in which the ſkin of the parts diſtended by a cold tumour became eryſipelatous, is ſufficiently evident from what he ſubjoins in the following chapter, where he ſays, *Quemadmodum autem ex bilioſa fluxione eryſipelas, ita ex phlegmate fit œdema, rarus quidam ac indolens tumor. Equidem ſcio aliter quoque œdemata provenire circa pedes in hydropicis affectionibus, phthiſibus, aliiſque pravis, qui vehementes ſunt, habitibus. Atque in illis quidem œdema plenitudinis hominem prementis eſt ſymptoma, nullam ſeorſum propriam curationem requirens, &c.* " But in the ſame " manner as an eryſipelas ariſes from a bilious afflux, " ſo an œdema may ariſe from phlegm, which is " then a ſoft and indolent tumour. I am indeed not ig- " norant, that an œdema may alſo ariſe in another " manner about the feet in dropſical diſorders, in " conſumptions, and in other violent depravations " of the habit; and in theſe indeed the œdema is a " ſymptom of the plenitude which oppreſſes the pa- " tient, requiring no particular or diſtinct treatment," *&c.* But although he calls it an indolent tumour from his preconceived opinion, that it aroſe from pituita, yet it is very evident from the remedies which he recommends for the cure of this œdema, that it was rather of a hot than of a cold diſpoſition; for a little afterwards he adds, *At ſi ex pituitoſo humore in partem influente œdema conſtitit, abunde aliquando ſatisfacit ſpongia ſola, quæ ex aqua, in qua ſit aceti aliquid, maduerit, &c.* " But if the œdema proceeds from the " afflux of a phlegmatic humour into the part, the " cure will be ſometimes fully accompliſhed only by " a ſponge, which has been moiſtened with vinegar " and water," &c.

Since therefore this œdema callidum has a true inflammation ſeated in the ſmalleſt lymphatic arteries, there will be always danger in this caſe, that the thin

lymph of the blood may acquire ſuch a coheſive diſpoſition, as may render it impervious and apt to obſtruct its ſmall veſſels; from whence the functions of the brain eſpecially may be diſturbed, as they depend on a free circulation of the finer humours through the ſmalleſt arteries, whether this diſorder be originally formed either in the encephalon, or by a tranſlation from ſome external part inwards. Add to this, that if the diſorder is violent, the ſmalleſt veſſels being deſtroyed may incline the parts to a ſudden gangrene.

Scirrhus with inflammation.] A ſcirrhus is a hard and unequal tumour, with little or no pain, ſeated chiefly in ſome glandular part. If it be confirmed or inveterate, it conſiſts of ſuch a matter as appears incapable of being diſſolved by any artifice, with which we are as yet acquainted, nor can it ever be ſeparated from the ſound parts by a mild ſuppuration. From whence it is evident how dangerous an inflammation is, when ſeated near a ſcirrhus, or when fixed in the integuments which inveſt a ſcirrhus, as it may then ſoon degenerate into a cancer, as we ſhall explain more at large hereafter, when we come to treat profeſſedly on a ſcirrhus. Galen [d] has very well diſtinguiſhed the hardneſs of a ſcirrhus from the reſiſtance of a phlegmon, when he ſays, *Phlegmone namque non durum (σκληρὸν) ſed reſiſtentem tumorem efficit (ἀντίτυπον) perinde atque utres ſunt liquida materia aut aere pleni*; "For a phlegmon is not hard, but occaſions a reſiſting tumour only in the ſame manner as when bladders are filled with any liquor or with air."

[d] Comment in Textum XXX. Epidem. Hippoc. Lib. VI. Charter. Tom. IX. pag. 389.

SECT.

SECT. CCCLXXXI.

BUT ſo often as theſe cauſes (375, 376, 377, 378, 379,) have produced this ſtagnation (371, 372, 379,) in the ſmall veſſels (372, 373, 374, 378, 379), then the blood, moved by the remaining vis vitæ, produces certain effects or ſymptoms, which are at the ſame time the proper ſigns of an inflammation.

Two cauſes are obſerved to occur in every inflammation ſeated in any ſeries of the arteries; namely, either an impervioufneſs of the fluids occaſioned by a narrowneſs of the veſſel, or a concretion of the particles, or elſe laſtly, from their miſtaking their courſe (*errore loci*;) and the propelled humours being at the ſame time urged forwards with an increaſed velocity into the impervious veſſels by the vis vitæ acting behind them. If theſe concur, an inflammation is preſent; but if there is only an impervioufneſs of the fluid, it affords the idea of obſtruction: which laſt is therefore the prediſpoſing or proegumenal cauſe of inflammation, while the procatarctic or acceſſory cauſe is the increaſed motion urging on the back of the obſtruction. But while theſe cauſes act, certain changes are produced in the inflamed part, which, being obſerved, afford the true diagnoſis of a preſent inflammation; but of theſe we are to treat in the following aphoriſm, in which they are enumerated in their proper order.

SECT. CCCLXXXII.

1. THE minute and ſcarce viſible obſtructed arteries are now enlarged by the diſtending blood, and from hence a red tumour. 2.

The arterial lymphatic veſſels, which were before pellucid and inviſible, do alſo ſuffer the ſame diſtenſion and alteration in colour; and from hence an increaſe of the redneſs; and eſpecially this, when the very ſmall veſſels and veſicles in the panniculus adipoſus are ſtuffed full of thick blood, deprived of its more fluid parts. 3. The ſmall veſſels being ſo far diſtended as to be near upon breaking their ſmalleſt fibres; from hence follows a pricking pain. 4. The ſolids and fluids are both violently compreſſed or compacted together, and from hence a hardneſs and reſiſtance in the part. 5. From an accumulation of the red blood which is violently impelled into the veſſels, ariſes a ſhining redneſs. 6. From the reſiſtance, pulſation, compreſſion of the veſſels as yet pervious, but made narrower by the enlargement or dilatation of thoſe which are obſtructed; thence ariſes a violent attrition of the parts of the juices againſt each other, and againſt the ſolids, as alſo of the ſolids againſt them; and from hence follows the heat or burning of the part. 7. Becauſe the blood impelled from the heart does by the force, which it acquires from that muſcle, dilate the ſides and extremities of the obſtructed veſſels; from hence follows a pulſation. 8. From an irritation of the fibres, and a ſwifter courſe of the blood through thoſe veſſels which are open, (ſince it is returned by the veins, but obſtructed in many of the arteries;) from thence ariſe a quick pulſe, fever, thirſt, heat, watchings, weakneſs, and uneaſineſs.

1. It was demonſtrated in the commentaries on § 120. where we treated of thoſe effects which followed

lowed from obſtruction as the cauſe, that the obſtructed veſſels were of neceſſity extended or dilated. For that force, with which the hearts propels the blood into the arteries, cauſes their ſides to recede from the axis of the veſſel, ſince they are full, and gradually converge, or become narrower. The reſiſtance therefore at the extremities of the arteries, and their fulneſs, are the principal cauſes why they are dilated by the impulſe of the blood: but in obſtructed veſſels there is the greateſt reſiſtance and at the ſame time the greateſt fulneſs, ſince nothing can be tranſmitted through their extremities; a great dilatation of them muſt therefore of neceſſity follow. If now we alſo conſider, that an inflammation is accompanied with an increaſed motion of the blood, it will evidently appear, that the veſſels muſt be more largely extended when there is an inflammation, than when they are barely obſtructed. But when this dilatation is made in thoſe arteries which naturally convey the red blood, or which admit the blood when they are dilated by diſeaſe, it is evident, that the tumour formed by that diſtention muſt appear red: for if an obſtruction or inflammation is ſeated in the ſmalleſt veſſels, they may be in the utmoſt diſtention which they are capable of bearing without a rupture, and yet may they exclude the red part of the blood, as we ſaid at § 379, and 380. Even this diſorder may be conceived to reſide in veſſels ſo extremely minute, that even the tumour reſulting from their dilatation may be too ſmall to come under the obſervation of our ſenſes. But concerning this ſee more in the commentary on § 122. But a true inflammation, properly ſo called, is always ſeated in thoſe veſſels, which either naturally contain the red blood, or which are capable of receiving it when dilated, as is evident from the definition given of it at § 371.

Beſides this the increaſed heat, which accompanies every inflammation, makes another addition to the bulk of the tumour, as will be preſently demonſtra-

ted at numb. 6. for it appears from certain experiments, that all bodies expand throughout all their dimenſions by an increaſe of heat.

2. A ſerous artery is derived from the leaſt ſanguiferous artery, in the ſame manner as a branch is derived from its trunk; but the ſides of the ſanguiferous arteries cannot be diſtended without diſtracting and enlarging the orifices of the ſerous arteries which ariſe from them; from whence the red part of the blood may enter through their dilated orifices. The ſame is alſo true with reſpect to the lymphatic arteries, which are derived from the ſerous arteries: for that theſe may be ſo diſtended, as to be capable of receiving the red part of the blood, is apparent in ophthalmias or inflammations in the eyes, as we ſaid a little before. From hence therefore will manifeſtly follow an increaſe of the redneſs of the tumour. But neither is all this ſeemingly ſufficient to produce ſuch enormous tumours as are frequently obſerved in violent inflammation. Now we demonſtrated in the commentary on § 374. that an inflammation fixes itſelf in no part more frequently and firmly than in the fat, when the ſmall veſſels of this membrane are ſtuffed up with impervious blood, and diſcharged through the orifices of the veſſels which open into the cells of the membrane; from whence this adipoſe membrane, which is ſo eaſily dilatable, is often diſtended in a ſurprizing manner. Galen [a] has very well obſerved this cauſe of the tumour in a phlegmon; for after having ſaid that no tumour can ariſe without the acceſſion of new matter to the ſwelled part, or without a diſſolution of the parts by the violent heat, ſo as to paſs into air, which might diſtend the part into a larger bulk; as for example in the ſame manner as water being rarified by heat into vapours, occupies an immenſe ſpace: but he proves that the tumour in a phlegmon does not ariſe from this rarefaction of the

[a] De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 313.

juices,

juices, so as to dissolve them into vapours of air; for says he, *Apparet enim, si secta fuerit pars phlegmone laborans, sanguis effluens plurimus, et locus universus sanguine pleniſſimus, quemadmodum spongiæ madentes; spiritus autem neque statim excidit, neque postea*; "For it appears, that if the part afflicted with a "phlegmon be laid open by incision, much blood "flows from it, and the whole part seems extremely "full of blood, in the same manner as spunges full "of water, but no air or spirit is discharged either "immediately or any time after." And in the end of the same chapter he adds [d], *In inflammationibus autem omnia sanguine replentur, ex vasis per eorum tunicas resudante, in omni vero carnis parte roris instar permixto*; "But in inflammations all the parts are filled "with blood, transuding through the coats of their "vessels, so as to mix like dew with every part of "the flesh." But by flesh Galen understands the tunica adiposa, as is evident from what was said in the commentary on § 374. as also from many other passages in his writings. For in the chapter lately mentioned he carefully observes, that a tumour, which accompanies an inflammation, is very different from that which arises from an increase of the habit of body; making use of the word πολυσαρκίας, to denote a greater obesity.

But when the red part of the blood enters the smaller dilated vessels, it there mixes both with the serum and thinner lymph contained in those vessels; but here the red part only of the blood remains impervious, being wedged into the narrowest parts of the converging vessels, while the more fluid parts will be carried off by the lateral vessels, which open betwixt the obstruction and the pressure which urges behind; and from hence the red part only will be more and more accumulated in the obstructing vessel, which

[b] De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 315.

will

will again prove another cauſe increaſing the redneſs in the inflamed part.

3. Since therefore the veſſels are diſtended by the impulſe of the humours urged on behind the obſtructing matter, from hence their coats, and conſequently the nervous fibres diſperſed through them, will be diſtracted; which will excite pain, as is evident from what has been ſaid in the commentaries on § 220, and 224. numb. 2. But ſince the largeſt veſſels which are interpoſed betwixt the ſanguiferous and the ſmalleſt arteries, (namely, the ſmalleſt extremities of the arteries which convey the red blood) does not equal in thickneſs the tenth part of a hair of the head, it is evident, that the diſtraction of the nervous fibrillæ diſperſed through the coats of ſuch a ſmall veſſel, muſt excite a pain, as if in a ſingle point of the body only; and from hence the pain is ſaid to be pricking. But one of theſe ſmalleſt ſanguiferous arteries is yet much larger than either the ſerus or lymphatic; though even in theſe, there is a like diſtraction and pain produced in a point ſtill leſs. So that a hundred of theſe ſmall veſſels being inflamed, will cauſe a pain as if it was fixed in a ſingle point; only becauſe the impulſe of the humours behind the obſtruction ſo diſtends the vaſcules, that the nervous fibres conſtituting their ſides, are in danger of breaking. And from hence it is that when ſo much blood is drawn from a vein in a violent pleuriſy, that the patient faints away, the pain either intirely vaniſhes, or at leaſt is much diminiſhed.

4. Our blood when at reſt ſeparates into two parts, the one a red concrete, and the other a watery ſerum, in which the red part ſwims. But there are two principal cauſes in the body which prevent this concretion; namely, a continual motion, and the interpoſition of a thinner fluid betwixt the red globules, by which they are removed from their mutual contacts. But when this red part of the blood ſtagnates in any of the ſanguiferous veſſels, or becomes impervious in any of

of the ſmaller dilated veſſels, its more fluid parts are expreſſed, as we ſaid before at numb. 2. under the preſent aphoriſm, from whence follows a compreſſure, and a combination of the red globules with each other, and as they are flexible, their ſpherical figure will be flattened, and they will touch one another in more points, and by that means begin to cohere more ſtrongly. Theſe cauſes therefore continuing, the red globules will be accumulated in the much diſtended veſſels, as alſo in the cells of the tunica adipoſa; and from hence a greater hardneſs and reſiſtance of the inflamed parts will neceſſarily follow. But as veſſels thus diſtended compreſs thoſe which lie next to them, the capacities of theſe laſt being thus diminiſhed will propagate the diſorder through the whole inflamed part. For this reaſon Hippocrates often places hardneſs and pain for an inflammation. Thus in his prognoſtics [c], in treating on an inflammation of the bladder, and the conſequences which thence follow, he ſays, *at veſicæ duræ et dolentes, &c.* And in other places, as Hollerius [d] remarks, he diſtinguiſhes a phlegmon from other tumours by the hardneſs and pain.

5. The thinner parts of the juices being expreſſed, leave only the red parts of the blood accumulated in the diſtended veſſels; whence (*cæteris paribus*) the redneſs is alſo much the greater, in proportion as the inflammation is more violent. But the ſkin being in moſt parts of the body looſe and moveable, is very much diſtended by the impervious blood ſtagnating in the adipoſe membrane, inſomuch that it ſhines with a ſmooth ſurface; for the tenſe ſkin always ſhines, as it is ſaid to do in fat people, being diſtended by the accumulated fat. Thus the well fed dog was aſked by the lean wolf from whence he ſhined with that fatneſs [e]. And we daily obſerve, that the tenſe ſkin

[c] Sentent. 71. Charter. Tom. VIII. pag. 659.
[d] Comment. in Coac. Prænot. Hippoc. pag. 552.
[e] Phædr. iii. 7.

looks

looks beautifully ſmooth and ſhining in young people, whereas in old age it is beſet with ugly wrinkles.

6. We are aſſured from certain experiments, that the moſt intenſe heat may ariſe barely from the attrition of bodies againſt each other, and even that actual fire may be by this way produced. (See our chemiſtry, vol. i. pag. 176.) It has been alſo proved that the heat ariſing from this attrition is ſo much the greater in proportion as the bodies are more rigid and elaſtic; and alſo that it increaſes in proportion as the bodies are more forcibly preſſed againſt each other, and as they are more ſwiftly agitated [f]. But it is certain that water or any other liquor being interpoſed between the bodies while they are rubbed againſt each other, prevents the heat from becoming ſo intenſe, as it will when there is no ſuch liquor interpoſed; from whence it would ſeem, that heat cannot eaſily ariſe from the attrition of our fluids againſt the ſides of their containing veſſels. But if we conſider that the globules of the blood are elaſtic, and alſo moved very ſwiftly through elaſtic veſſels, which converge in ſuch a manner, that in the ultimate extremities of the ſanguiferous arteries, hardly more than a ſingle globule can paſs through at a time; and that therefore the more thin parts of the juices being carried off by the lateral branches, the largeſt globules will be ſtrongly preſſed and rubbed againſt the ſides of the veſſels; from hence it is ſufficiently evident that heat muſt ariſe from this attrition; ſo that in ſtrong people who have a thick blood, a greater heat is uſually obſerved. But when the blood, being diſſolved, inclines more to the nature of inelaſtic water, the heat is always obſerved leſs, and for the ſame reaſon a greater heat always accompanies a ſwifter motion of the blood through its veſſels. Nor is it any objection to this, that the impervious blood

[f] Videatur de his omnibus Boerhaavii Them. Tom. I. pag. 176, &c.

ſtagnates in the obſtructed veſſels of the inflamed part; ſince it appears from the experiment of Lewenhoeck, alledged in the commentery on § 132. that ſuch impervious particles of the blood are repelled back by the contraction of the artery, at the inſtant when the heart does not act, and that ſoon after they are again propelled to the obſtructed part of the artery, while the blood is ſent forward by the ſyſtole of the heart; whence it is evident that thus the obſtructing particles may run forwards and backwards in the ſame veſſel. But ſince it appears from what has been ſaid before, that the thinner juices are continually expreſſed, while the groſs and impervious particles of the blood are accumulated and condenſed, while the velocity of the blood's motion is alſo augmented through the inflamed part, the reaſon will be evident, why ſuch a conſiderable increaſe of heat muſt neceſſarily follow. But the adjacent veſſels which are not yet obſtructed, will be compreſſed and made narrower by the diſtention of the inflamed veſſels; whence will follow a greater attrition of the compreſſed veſſels, partly from a diminution of their capacity, and partly from the increaſed velocity of the fluids to be tranſmitted. For if out of an hundred veſſels, fifty of them are obſtructed, the blood muſt then paſs as ſwift again through the fifty which remain pervious. Every circumſtance therefore concurs in an inflammation from which we are aſſured by experiment a greater heat may ariſe. For the blood being deprived of its more fluid parts, concretes almoſt into a ſolid maſs, which is every moment condenſed more and more by the violent action of the veſſels, and the impulſe of the humours acting behind: the veſſels compreſſed by thoſe which are diſtended, will be applied more ſtrongly to their contained humours, and the motion of the fluids through the veſſels will be in general accelerated. From hence the reaſon appears why an inflammation does by the ſimilitude of its cauſes and effects derive its name from fire, as was ſaid before § 370.

7. Since the whole body is found, by the modern anatomy, to contain arteries diſperſed throughout almoſt every point of it; and that all theſe arteries are dilated at one inſtant of time, while the heart is in its contraction, and that they are again contracted the moment following, while the heart is in its dilatation; it will be evident, that almoſt every point of the body receives a motion of pulſation every moment of life. But we do not naturally take any notice of this motion; even though it is very ſtrong, and always performed in our bodies by the ſame laws; but ſo ſoon as this motion exceeds its uſual bounds, we preſently perceive it. Thus the ſtrong pulſation of the heart, which may be ſo eaſily perceived by applying the hand to the breaſt, is not at all felt by a perſon in health; but ſo ſoon as it exceeds its due motion by paſſions of the mind, a violent motion of the body, *&c.* then the heart is perceived immediately to palpitate. It is no wonder, therefore, that a pulſation ſhould be perceived in the inflamed part, which was not obſerved in it before; for the blood thrown into the obſtructed arteries by the force of the heart, will ſpend all its force in removing the ſides and extremities of thoſe arteries; and from thence the ſides of the arteries will recede farther from their axis, and when the force of the heart ceaſes, they will return or contract again with ſo much a greater force, in proportion as they were more diſtended. The pulſe will be therefore thus increaſed in the inflamed part, and being raiſed in ſtrength and velocity beyond its natural action, it will be very diſtinctly perceived.

8. When the ends of the arteries are obſtructed, the humours contained in the veins, correſponding to thoſe arteries, do nevertheleſs return to the heart; but being afterwards propelled by the heart, they cannot paſs through the obſtructed arteries, but muſt run with ſo much a greater velocity through thoſe arteries which remain pervious. For, in this caſe, the quan-

quantity of humours to be tranſmitted through the veſſels, is not diminiſhed, though there is a leſs number of the pervious or tranſmitting veſſels; from whence it is ſufficiently evident, that the blood muſt paſs with an increaſed velocity through the other veſſels which remain pervious. But, at the ſame time, it is alſo from hence apparent, that this cauſe will not be ſufficient to increaſe the velocity of the humours, ſo as to render it ſenſible to the phyſician, unleſs the affected part is ſo large, that the number of its impervious veſſels will make a conſiderable difference, when compared with thoſe that remain open: for if a thouſandth part of the arteries are thus obſtructed by an inflammation, the increaſed velocity required to move the blood through the reſt of the open veſſels, ſeems to be ſcarce within the reach of obſervation. Another cauſe is therefore neceſſary to account for the frequent attendance or following of a fever after an inflammation; which fever we frequently obſerve, even when the inflammation is ſeated in but a very ſmall part of the body: for thus a very violent fever often attends, when an inflammation is ſeated in but a very ſmall membrane; as, for inſtance, in the paronychia or witloe. Therefore it is added in the text, from an irritation of the fibres. When we treated of the effects of pain, in the commentary on § 226. it was demonſtrated, that a fever might ariſe from pain only; and for the ſame reaſon a violent fever ſo frequently accompanies the moſt painful inflammations: whereas an inflammation is not often attended with a fever, when there is little or no pain; whence it follows, that the fever ſeems to ariſe chiefly from the irritation of the nervous fibres diſperſed through the inflamed veſſels and membranes, which are too violently ſtretched or preſſed. That there is in reality ſuch a power or diſpoſition in our veſſels, as renders them liable to irritation, whereby the circulation of their humours is accelerated, we are taught by many obſervations.

When

When the offending matter is diſſolved in acute diſeaſes, it flows through the veſſels, and is often tranſlated or ſettled upon ſome other part, or elſe it is diſcharged from the body by critical evacuations; and in theſe changes, what wonderful diſturbances frequently ariſe in the body? and in what a ſurprizing manner is the pulſe often accelerated and diſcompoſed? When the chyle, which is made from too large a quantity of aliments, or from ſuch as are more compact or acrimonious than uſual, comes to circulate with the blood through the veſſels, it produce a fever; but of this we ſhall treat hereafter, in the hiſtory of fevers; and it may be at preſent ſufficient for us, only to obſerve this in general, in order to ſhew, that an irritation of the fibres may produce a fever.

But the ſigns of a fever attending, are the appearance of its chief ſymptoms, thirſt, heat, watchings, *etc.* of which we ſhall treat particularly in their proper places. But it is to be obſerved, that theſe ſymptoms do not attend every inflammation, but only when the whole maſs of blood has acquired ſuch an inflammatory ſpiſſitude, that it cannot eaſily paſs through the ſmalleſt veſſels. For it appeared before, that in healthy blood there is naturally an inclination to concretion, and the more, as the patient was of a ſtronger habit: but ſo long as this tendency to concretion can be overcome by the action of the veſſels in the viſcera, ſo long will the patient ſurvive. But we ſee daily in acute diſeaſes, that the blood is ſo much altered that at length it ſcarce retains its fluidity; it immediately congealing if not prevented by the frequent action or attrition of the veſſels. Thus the blood which drops from the noſe in ardent fevers immediately congeals into a ſolid maſs; inſomuch that often this thick blood ſtops up the ſmall arteries which were opened by nature to make a ſalutary diſcharge, in order to terminate the diſeaſe. Hence Hippocrates [g] juſtly condemns theſe ſmall diſcharges o

[g] N° 59.

blood

blood, in his Prænotiones Coacæ; and in another place [h], he gives inſtances of three patients, proving the fatal event, when this diſcharge of blood from the noſe was very ſmall on the fourth and fifth day. When therefore this inclination of the blood to concretion is augmented, it is ſufficiently apparent, that it will meet with more difficulty in paſſing through the ſmalleſt arteries; from whence will ariſe a greater reſiſtance to the heart: and ſince the lungs ought to receive and tranſmit the blood, which it immediately receives from the right ventricle of the heart, through the ſmalleſt extremities of its pulmonary artery; therefore the leaſt inclination of the blood to run into coheſions will be perceived in the lungs, whence again the reſpiration will be increaſed, in order to protrude the blood more forcibly through the lungs. Thus ariſes that uneaſineſs or anxiety, which is a bad ſign in all acute diſeaſes, and eſpecially in the inflammatory; that is, the reſpiration becomes laborious and difficult, and the patient declares his anxiety and uneaſineſs by continually changing the poſture of his body. This is the δυσφορία, or heſitation of the blood, as it is called by Hippocrates, which though it may be the conſequence of other cauſes (as will be hereafter declared in § 631, et ſeq.) does yet more frequently proceed from an impervioufneſs of the blood.

It is therefore evident, from all that has been ſaid under this aphoriſm, that a phlegmon is known by theſe ſigns, to be a red tumour, tenſe and ſhining, with a pricking pain, heat, and pulſation, accompanied with a fever, either in the whole, or at leaſt in that particular part of the body.

[h] Epidem. I. Textu 63. Charter. Tom. IX. pag. 65.

SECT. CCCLXXXIII.

AND this is the ſtate (382) of a phlegmon before the diſorder has arrived to its full height.

All the ſigns enumerated under the preceding aphoriſm are obſerved in a phlegmon, which is increaſing, but has not yet arrived to its full height: for there are three ſtages obſerved by phyſicians in all diſeaſes; namely, their increaſe, height or ſtate, and their declenſion. Their increaſe is ſaid to be as long as all their ſymptoms grow worſe; and the ſtate or height of the diſorder, is, when the ſymptoms are arrived to their greateſt degree of malignity, and do not afford any ſenſible ſigns of their augmenting or diminiſhing; but the declenſion of the diſorder is when the violence and number of the ſymptoms gradually diminiſh. Thus when a phlegmon has arrived to its full height, it then begins to be diſpoſed to terminate either by reſolution, which we call health, or into ſome other diſeaſe, as an abſceſs by ſuppuration, a gangrene, a ſphacelus, a ſcirrhus, *etc.* as we ſhall preſently declare more at large. But at the time of change, many of the ſigns or appearances which accompanied the phlegmon as not yet adult, are conſiderably altered, or elſe removed, and other new ſigns appear, which were not to be obſerved before: Thus, for inſtance, the redneſs, tenſion, pain, and hardneſs, which are obſerved in a phlegmon, begin to diminiſh when it tends to a gangrene, and at length they even quite vaniſh, and are, on the contrary, ſucceeded by an inſenſibility of pain, a pale aſh or brown colour, flaccidity, puſtules full of ichor, *etc.* Theſe ſtages are therefore to be carefully diſtinguiſhed, as well in a phlegmon, as in other diſeaſes, in order to determine

determine any thing with certainty in relation to the diagnoſis, prognoſis, and curative indications.

SECT. CCCLXXXIV.

IF now blood be drawn, in a full ſtream from a larger orifice in a vein, into a baſon; as it grows cold, it forms a white, hard, thick and tough ſkin, almoſt like the ſkin of pork.

When blood is drawn from a perſon who has a violent inflammation, it affords an appearance ſurpriſing enough. It is well known, that the blood congeals ſometime after it has been received from the vein, and ſtood ſtill in a baſon; and that it then ſeparates into two parts; the one a thin yellow coloured liquor, and the other a red concrete, uſually ſwimming in the former; which laſt is uſually termed the craſſamentum. But in acute, and moſt of the inflammatory diſeaſes, the upper ſurface of the craſſamentum appears covered with a white or light bluiſh coloured ſkin, which is frequently ſeveral lines thick, and is ſometimes ſo tough, and firmly adhering to the craſſamentum, that it with difficulty admits of being divided, even by a razor. As this tough ſkin is almoſt conſtantly obſerved in the blood of thoſe who are afflicted with a pleuriſy, therefore when phyſicians ſee the ſame appearance in the blood extracted in other diſeaſes, they term it pleuretic blood, though it is not reſtrained to a pleuriſy only. There are ſeveral obſervations more than a little ſurpriſing, to be met with in authors concerning this appearance; thus Sydenham[a] has remarked, that if the blood does not flow in a direct or horizontal ſtream, but runs trickling down over the ſkin, that then this tough cruſt will not appear on the ſurface of the blood, even though it flowed faſt enough from the orifice; and

[a] De Pleuritide, pag. 333, 334.

he ingenuously confesses himself ignorant of the cause of this difference. He has also observed, that the patient is not relieved by that manner of bleeding as he is when the blood runs in a full stream, and appears covered with this crust; and he takes notice, that any other obstacle which impedes the free exit of the blood from the orifice of the vein, will also hinder the generation of this crust or skin, and occasion the patient to be less relieved by it. But what is still more wonderful, it has been observed that this skin will not be formed, even though the blood has been drawn in a full stream from the vein, provided it is but stirred round with the finger: Therefore the origin of this crust appearing on the surface of the venal blood, seems to be very obscure. But whether or no it is produced from the serum of the blood, inclined by disease to a greater degree of cohesion, is what may be questioned; though it is certain that it always occupies the surface or upper part of the crassamentum, which swims in the serum. Whether or no is it formed of the crude chyle, not yet converted into the blood? This is the opinion of the acute Simson [b], but it seems to be an objection to this, that the chyle mixed with, and not yet converted into the blood, must swim in the serum, and not cohere to the crassamentum. The same author observes, that if a strict ligature be made about the arm or thigh, and a vein be opened three or four hours afterwards, so as to let the blood flow out in a full stream, that then this skin will always appear; as it is also constantly found in the blood of women with child. Whence he places the cause of it in the remora or stagnation which the blood suffers in the vessels, obstructed sometime by ligatures, or by the pressure of the uterus in gravid women; or at least because it is moved more slowly. To speak the truth, I must confess myself in a doubt what to think concerning this tough skin, which always most firmly

[b] De Re Medica Differt. quatuor, pag. 112.

adheres

adheres to the ſurface of the craſſamentum. It is the opinion of many learned and eminent phyſicians, that this cruſt is formed while the blood is more inſpiſſated and inclined to concretion by an increaſed velocity of its motion; and therefore they judge it to be rather an effect or conſequence than a prediſpoſing cauſe of the diſeaſe. But I have frequently obſerved, that ſuch a cruſt has appeared in the blood of the moſt healthy people, who open a vein every year in the ſpring; and even in a weak man, who bled every three months to prevent an hæmopthoe: in which caſes there was therefore ſuch a diſpoſition of the blood, even though there was no inflammation; and on the contrary, no ſuch cruſt has been obſerved in ſome of the moſt violent inflammatory diſeaſes, which has then been always received as a very bad ſign.

SECT. CCCLXXXV.

THE diſorder increaſing, all theſe ſymptoms (382, 383, 384,) continue, but in a greater degree; and in the mean time the expreſſed lymph is carried off, and the red blood more inſpiſſated.

All the ſymptoms which have been hitherto conſidered, aroſe from the heſitation of the impervious blood in the ſmalleſt extremities of the converging arteries, and from the impetus of the blood more forcibly impelled behind, and urging on the back of theſe obſtructions: if therefore the tenacity of the obſtructing matter is increaſed, or takes place in more of the ſmall veſſels, while the impulſe of the blood urging behind is alſo augmented; it is very evident, that then all the ſymptoms muſt be increaſed. From hence a greater tumour of the inflamed parts, with a colour inclining towards purple, by reaſon of the extreme redneſs, a burning heat, intenſe pain from the diſtracted fibres being almoſt upon the point of break-

ing, with an extreme tenſity or ſhining of the part, *etc.* And ſince the blood cannot paſs through the obſtructed veſſels, into which it is propelled, the thinner parts will go off by the lateral veſſels, the red part will remain alone impervious, and will be applied and compacted againſt the obſtructing matter by the force of the blood urging behind; from whence the quantity of obſtructing matter will be continually increaſing, and therefore its removal will become the more difficult.

SECT. CCCLXXXVI.

IF the circulating humours are mild or not acrid, their motion ſedate or not exceſſive, and the obſtructing cauſe not too violent, the obſtruction itſelf alſo but ſmall, and ſeated either in the ſanguiferous or in the beginning of the lymphatic arteries, then the obſtructing matter concreted by ſtagnation, being reduced to a ſtate of fluidity by the motion of the veſſels or diluting juices, the inflammation then terminates by a reſolution or diſperſion.

Every diſeaſe terminates either in health, another diſorder, or in death; which is a general rule that takes place likewiſe in inflammations: and therefore we are next to conſider the various ways in which they terminate. When the inflammation is ſo diſperſed, that nothing of the diſorder remains, and all the parts are reſtored to their functions which they formerly performed in health, without any other diſorder following, it is then ſaid to be cured. But if the inflammation turns to a ſuppuration, the firſt diſorder is indeed removed, but then another comes in its place; namely, an abſceſs follows. The ſame is alſo true if the inflammation turns to a ſcirrhus. But when a moſt violent inflammation totally intercepts the

the vital influx and efflux of the humours to and from the affected parts; in that case the inflammation indeed ceases, but is followed with a gangrene first, and then with a sphacelus, which last is a true mortification or death of the part.

Of all the ways therefore of terminating an inflammation, the most desirable is that which physicians call a resolution or dispersion. That is, when the impervious matter, hesitating in the obstructed vessels, is by the remaining vis vitæ and the use of proper remedies so dissolved, or the vessels in which it is seated so disposed as to let that impervious matter pass into the veins, or else be repelled back into the larger vessels: so that thus a free circulation of the humours is restored through the vessels, before impervious, without injuring their continuity; and the concreted fluid being now dissolved, and mixed with the circulating humours, may pass freely through those narrow extremities of the vessels, which it ought to pervade agreeable to the laws of health. And when this takes place, the inflammation is said to be cured by a resolution.

It therefore remains for us to enquire into those signs which denote that this resolution is practicable; and all these we find enumerated in this aphorism. For the treatment is required to be very different, when it shall appear, that the inflammation will terminate in a different manner from that above mentioned, as will appear evidently from what follows.

If the circulating humours are mild.] All our healthy juices (except perhaps the bile, and those which are excrementitious) are so mild and inoffensive that they do not excite pain, even though they touch the eye or a naked nerve in a recent wound: and this was necessary, that they might pass with a pretty strong impulse in a healthy state through their very tender vessels, and yet not injure them. Since therefore the resolution of an inflammation supposes a motion of the stagnating humour, and a restitution

of its concreted parts to their former fluidity, without any deſtruction of the veſſels; it is very evident that in this caſe they can have no conſiderable acrimony. for when the blood is forcibly impelled by the heart into the obſtructed veſſels, it is then preſſed back again by the contraction of thoſe veſſels, while the heart is in its diaſtole; by which means the ſides of the veſſels will ſuffer a conſiderable attrition from the humours, ſo that if they contained acrimonious particles, it is evident that theſe tender ſmall veſſels would be diſſolved and deſtroyed. This is the reaſon why, in ſcorbutical patients, the ſlighteſt inflammation ariſing in the legs, even from external cauſes, can hardly ever be cured by a reſolution; but it almoſt conſtantly degenerates into an ulcer; and the ſame is alſo obſerved in all other ill habits of body, in which the juices are infected with an acrimony.

Their motion ſedate.] It was demonſtrated in the commentary on § 120, that when an obſtruction is formed, the obſtructed veſſel is diſtended, dilated, and rendered thinner by the impulſe of the fluids; ſo that it at length burſts aſunder. But in that caſe the humours had no greater velocity than is uſual in an healthy ſtate; and it is very evident, that if the impulſe of humours in the obſtructed veſſels is increaſed, the ſolution of their continuity will be more ſpeedily effected. But in order to diſperſe or reſolve an inflammation, it is required to preſerve the continuity of the veſſels; and therefore when an inflammation is accompanied with the moſt violent motion of the humours, there can be no hopes of a reſolution.

The obſtructing cauſe not too violent or confirmed.] An increaſed motion of the humours is not only prejudicial, inaſmuch as it may break the continuity of the obſtructed veſſels, but alſo inaſmuch as it compacts the obſtructed particles together with a greater force. But to diſperſe an inflammation, it is required to reſolve the obſtructing concrete into thoſe ſmall particles,

particles, by whoſe combination the obſtruction is formed: but the more the thinner humours are expreſſed, which prevent the mutual contacts of the groſſer particles; ſo much the more ſtrongly will theſe laſt be united and preſſed together, the more firmly will they cohere, and the more difficult will it be to diſſolve them again. But when the velocity of the circulation is increaſed, the thinner humours are diſſipated, and the groſſer compacted together, as we demonſtrated in the commentary on § 100, and at the ſame time the compacting cauſes, which drive the impervious particles cloſe to each other in the obſtructed veſſel, are oftener applied in a given time. Hence appears the reaſon why the moſt ſkilful phyſicians deſpair of a reſolution in a pleuriſy and ſuch like diſeaſes, in which a moſt violent fever has attended for above twelve hours time, and rather direct all their curative intentions to promote the concoction and excretion of the inflammatory matter.

The obſtruction ſmall, and ſeated either in the ſanguiferous or in the beginning of the lymphatic arteries.] An obſtruction is ſaid to be ſmall, either with regard to the part of the veſſel which it occupies, or elſe becauſe it takes place in but a few veſſels of the part affected. Thus for example, if a red globule ſtagnates in the beginning of a dilated ſerous veſſel, that obſtruction may be more eaſily removed, than if the globule penetrated to the ſmalleſt extremity of the ſame ſerous artery. And alſo if the greater number of veſſels in any part of the body are obſtructed, each of theſe being dilated will compreſs and ſtraiten thoſe which are adjacent; whence the reſolution of ſuch an obſtruction will always become the more difficult. But an inflammation may be diſperſed moſt eaſily of all, when *(cæteris paribus)* the diſorder is ſeated only in the larger veſſels: for the efficacy of bleeding, and moſt of the other remedies for inflammations, is exerted chiefly in the larger veſſels. Thus for example, if the red part of the blood ſtagnates in the

the ſmalleſt extremities of a ſanguiferous artery, or has entered into the ſerous veſſels by error of place, or elſe into the lymphatics which are of the next magnitude to the ſerous veſſels, it is evident that the obſtructing matter ought to be ſo attenuated or diſſolved, or the obſtructed veſſels ſo relaxed as to afford a paſſage; or elſe, laſtly, the obſtructing matter muſt be repelled back from the ſmaller to the larger capacity of the veſſel. But a red globule readily diſſolves into the ſerous globules of which it is compoſed, according to the obſervations of Leeuwenhoek; and thus likewiſe may the ſerous globules diſſolve into the ſmaller lymphatic ones; therefore ſuch an obſtruction, ſeated in the ſanguiferous or in the beginning of the ſerous and lymphatic arteries, may be thus terminated or reſolved. But if a red globule ſhould have entered veſſels much ſmaller than theſe, it would not be capable of paſſing through its ſmaller extremities, even though it was to be reſolved into ſerous or lymphatic globules; from whence the difficulty of reſolving the inflammation in this caſe is ſufficiently evident. Another means of the greateſt efficacy in the reſolution of inflammations, is the diminution of the quantity and impulſe of the humours urging on the back of the obſtructions, made by a plentiful bleeding, that the obſtructing matter may be repelled by the natural contraction of the veſſels from their narrower to their larger capacities, (ſee § 141.) This repulſion depends upon the re-action of the veſſel, when the cauſe of its diſtention ceaſes, and therefore it will take place the moſt effectually in the largeſt veſſels, which have the ſtrongeſt and moſt elaſtic membranes or coats; whereas little good can be from hence expected, when the obſtruction is ſeated in the ſmalleſt and moſt tender vaſcules. From hence therefore the reaſon is evident, why it is neceſſary for the obſtructing matter not to be ſeated in the ſmalleſt veſſels, in order to cure the inflammation by a reſolution or diſperſion. This is confirmed by many

ny practical obſervations, and is moſt apparently demonſtrated in an ophthalmia, in which diſorder we may very plainly perceive the inflamed veſſels of the eyes. For as long as the veſſels of the tunica adnata only appear, and there is no apparent defect in the pellucid cornea, there are great hopes of obtaining a perfect reſolution without any defect remaining: but when the very minute and pellucid vaſcules of the cornea are dilated ſo as to admit the groſſer humours, the inflammation can never be ſo entirely diſperſed, but either a ſuppuration or opake ſpot will be left in the cornea, which will ſometimes diſfigure the eye as long as the patient lives.

The veſſels moveable.] For the maintenance of health it is required that our veſſels yield to the impulſe of the fluids; and then again for them to return to their former diameter, when the diſtending cauſe ceaſes; and this is called the mobility of the veſſels. Now there are two different and even oppoſite cauſes, which diminiſh, and may even ſometimes totally deſtroy the due mobility of our veſſels; namely, when their ſides or coats are ſo much relaxed, that they very eaſily give way to the humours impelled by the heart, but have ſo ſmall a degree of ſtrength or elaſticity, that when the heart ceaſes to act, their force is not ſufficient to propel forwards their contained blood; and on the contrary, the ſides of the veſſels are ſometimes ſo rigid, as ſcarcely to ſuffer them to be dilated by the impulſe of the humours. The firſt of theſe defects is therefore a too great weakneſs, and the latter, a too great ſtrength of the veſſels. When the veſſels are too weak, they may be ſo dilated, even by a ſmall force, as to admit the groſſer parts of the blood to miſtake their courſe; but then, as they eaſily give way in this caſe, their ultimate extremities may be ſo dilated, as to readily tranſmit the groſſer obſtructing parts of the blood into the veins; whence it will be no great difficulty to remove the obſtruction. To which add, that in this caſe

caſe the motion of the humours is always languid, and the fluids are never denſe or compact for want of ſtrength in their veſſels; whence it readily appears, that inflammations ſeldom ariſe in ſuch habits, and that there is no great difficulty in curing them when they do ariſe. But when there is too great a ſtrength in the veſſels, the blood is always compact or denſe, and deprived of its more fluid parts, which will cauſe the more groſs parts to unite, and render the inflammation difficult to remove when it is once formed; and this partly from the thickneſs and impervioufneſs of the humours, and partly from the greater ſtrength or contractal power of the obſtructed veſſels, by which they reſiſt dilatation, and more ſtrongly confine the obſtructing particles. This is daily obſerved in practice, where acute or inflammatory diſeaſes in women or children are often eaſily cured by a mild reſolution; but very ſeldom in adults, and thoſe who have been inured to hard labour. The ſame has been alſo obſerved by Hippocrates [a], who ſays, *Corpora exercitata ac denſa citius à pleuriticis et peripneumonicis morbis pereunt, quam non exercitata*; "Strong bodies uſed to exerciſe periſh ſooner by "pleuritic and peripneumonic diſeaſes than thoſe who "are not uſed to exerciſe."

Diluting vehicle or juices.] When the moſt fluid parts of the blood are diſſipated in the beginning of acute diſeaſes, either by ſweats, a diarrhœa, or any other evacuation, there is always great danger of a fatal event. For the groſſeſt particles of the blood are not prevented from concreting or touching each other, but by the interpoſition of the more thin humours.

When blood is drawn from an healthy perſon, it appears an uniform fluid; but by ſtanding it diſſolves into two diſtinct parts: for the red globules unite and cohere, while the ſerum ſeparates from thence. But if blood newly drawn be ſtirred about with a ſtick till

a Coac. Prænot. 318. Charter. Tom. VIII. pag. 875.

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it is cold, the separation of the serous from the red parts of that blood will be prevented, and the whole mass will remain a fluid; from whence it appears how necessary a thin diluent liquor is to prevent a concretion of the blood. For this reason Hippocrates condemns a wasting of the more fluid parts of the blood by sweats, a diarrhœa, *etc.* in the beginning of acute diseases: for he says [b], *Sudor multus, cum febribus acutis obortus, malus. In febre ardente, si alvus affatim proruperit, lethale*; "That a profuse sweat "arising with acute fevers is bad;" [c] and "that a "profuse diarrhœa is fatal in an ardent fever." It is also remarked by Sydenham [d], (who so diligently attended the endeavours of nature in the cure of diseases,) that if the patient is infested with profuse sweats in the beginning of the small-pox, all the symptoms are constantly augmented or rendered more violent.

If all or most of the circumstances before enumerated, attend an inflammation, there is reason to hope it may be dispersed without incurring any defect or morbid alteration; but this is not by discharging the morbid matter, nor by destroying the vessels; but by opening the obstructed vessels, and rendering the impervious matter more fluid. But if some of the conditions before mentioned, as necessary to a resolution, be absent; we are then to endeavour to supply their deficiency by art. The humours are to be rendered mild by a softening diet and medicines; the too great velocity of the circulation is to be quieted by bleeding, rest, a cool air, *etc.* the vessels of the affected part are to be relaxed by applying fomentations, that they may give way more easily to the obstructing matter; a diluting vehicle is also to be supplied by a thin and watery drink, avoiding every thing at the same time which tends to drain off the most fluid

[b] Prorrhet. Lib. I. n°. 57. Charter. Tom. VIII. pag. 740.
[c] Coac. Prænot. n°. 130.
[d] Sydenham, Opusc. Universa, pag. 321.

part of the humours from the body. But of all these we shall speak more largely in the cure of an inflammation following.

SECT. CCCLXXXVII.

If the circulating humour is mild, its motion rapid, the obstruction great and incapable of resolution (386); then the symptoms increasing (382, 384, 385), the distended vessels break with pain, heat, pulsation, and tumour; they extravasate their contained humours, which are then dissolved and gently putrefied, and do themselves break off and dissolve the adjacent solids, which mix with the fluids, and form a similar, white, thick, glutinous, and unctuous humour called pus or matter; and this, which is termed *suppuration*, is the second way in which an inflammation is often terminated.

When the obstructing particles are so firmly compacted in the extremities of the converging vessels, that there is no passage afforded for the diluting vehicle to dissolve and carry them into the veins; the increased motion of the fluids, acting behind, still continues to force the obstructing particles further into the more narrow parts of the vessels; from whence it is evident, that at length the impervious matter will be most violently compressed, and stagnates without the least motion in the obstructed vessel, from the narrowest part of which it cannot be repelled towards the broader basis. Therefore the whole length of this inflamed vessel will be quite destitute of the vital influx of the humours, and therefore it will be necessary for it to separate from the other living and sound parts. Now we are assured from a diligent attention to nature in the cure of diseases, that a suppuration

puration separates every part, which was destroyed by the inflammation, from those which are living and sound: from whence it is evident, that a suppuration is not so much to be feared, except in those parts of the body, whose continuity is absolutely necessary for the maintenance of life and health; as for instance in the encephalon, or in a part where the matter cannot be safely extracted, as in a pleurisy, *etc.* But in what manner all those parts, which have been rendered unfit for receiving the vital motion of the fluids, are separated by suppuration, may very well appear from what has been said of this subject in the history of wounds; where we enumerated all those appearances which are observed in an healthy body in every wound, from its first infliction to the completion of its cure, (see the commentary on § 158.) For in the first place the blood is extravasated from the wounded vessels, whose orifices contracting, then discharge only a thin and reddish ichor; the surface of the wound now appears almost dry, and a true inflammation arises from the vital motion of the humours urging against the obstructed ends of the vessels; as is evident from the pain, heat, redness, tumour, slight fever, thirst, *etc.* In the next place the extremities of the impervious vessels separate, together with part of the impervious fluid impacted in the extremities of those vessels; whence arises a viscid, white, and unctuous fluid, called pus or matter, upon the surface of the wound; and after a careful abstersion of this matter, the whole surface of the wound appears evenly moist, which is an evident sign that the vessels, which were before obstructed, are now opened by a separation of their impervious and contracted extremities. A suppuration is therefore that salutary endeavour of nature, by which she separates from the other sound and living parts every thing which is become unfit for receiving the vital circulation. Hence Hippocrates well observes, (see the passage cited § 158. numb. 7. and § 323.) that a wound inflicted by a sharp instrument

ment may be cured without ſuppuration; but that contuſed and diſſected fleſh muſt putrefy or waſte away by turning into matter. But although he here uſes the word putrefy, when he treats of a ſuppuration; we are not therefore to underſtand ſuch a putrefaction as happens in a dead body, but a different kind of degeneration in the humours made by the life remaining. This has been very well diſtinguiſhed by Galen[a], where he treats of fevers; for he recommends urine that has a white ſediment, which is light and uniform, as a very good ſign, denoting that the matter of the diſeaſe is attenuated and evacuated from the body. But he calls this change in the urine a corruption, where he ſays, *Putredo autem humorum, quæ fit in vaſis, ſimilis eſt illi, quæ fit in inflammationibus et abſceſſibus et aliis tuberculis, etc.* "But the putrid ſtate, which the humours acquire "in the veſſels, is like that which happens in inflam- "mations, abſceſſes, and other tumours, *etc.* He likewiſe tells us there are two kinds of this corruption; *Alterum nempe fieri, vincente natura; alterum vero, devicta. Vincente quidem natura, uti in inflammationibus et tuberculoſis omnibus tumoribus pus fit; in humoribus autem arteriarum et venarum illud, quod ſubſidet in urina puri analogum. Hæc autem putredo non ſimpliciter putredo eſt, ſed aliquid coctionis habet. Manente enim concoquendi facultate vaſorum, putreſcens tunc humor ad talem alterationem deducitur*; "Namely, "one of them which happens when nature over- "comes the diſeaſe; and the other when the diſ- "eaſe overcomes nature. When nature overcomes "the diſeaſe, there is a formation of matter like that "which is made in inflammations, and as happens in "all tumours; but that which ſubſides in the urine "reſembles matter, when in the humours of the arte- "ries and veins. But this kind of corruption is "not ſimply a putrefaction, but a kind of concoc-

[a] De Febribus, Lib. I. cap. 7. Charter. Tom. VII. pag. 115. et ibid. cap. 8. pag. 116.

"tion

" tion or digeſtion; for while the digeſtive or atte-
" nuating power of the veſſels remains, the corrupt-
" ing humour is reduced to the ſtate abovementioned."
From hence it evidently appears, that the formation of matter is very different from a ſpontaneous putrefaction of the humours.

But the change of an inflammation to ſuppuration, when it is not reſolvable, ſeems to be performed in the following manner. The humours urge up on the back of the obſtructions, and enter the obſtructed veſſels at every contraction of the heart, with a velocity increaſed by the attending fever; from hence the ſides of the obſtructed veſſels will be gradually diſtended, and ſeparated from their cohetion with the extreme parts which remain obſtructed: but while this is performing, the humours are extravaſated from their ruptured veſſels, and being attenuated by the warmth of the parts, they enter into an incipient putrefaction and diſſolve both the impervious fluids, which heſitated in the extremities of the ſeparated veſſels, together with the tender ſolid parts, which before contained the obſtructing matter; all which being worked up together, attenuated and intimately mixed with the extravaſated juices, they receive ſuch a change by warmth and ſtagnation, that the whole forms a ſimilar or uniform fluid, called pus or matter. It may perhaps ſeem ſurprizing, that the ſolid membranes of the veſſels ſhould be thus diſſolved, and mixed with the juices, in ſuch a manner as to form a fluid which is uniform in appearance; but the difficulty will be removed, if we conſider the incredible tenuity of theſe ſmall veſſels. For it appears from the eſtimates made from the obſervations of Leeuwenhoeck and other learned men, that almoſt fifty millions of red blood globules, do but equal the weight of a ſingle grain [b]. But the ſmalleſt ſanguiferous arteties tranſmit only one ſuch globule at a time; from whence it is evident how ſmall and tender theſe vaſ-

[b] Medical Eſſays, Tom. ii. pag. 113.

cules muſt be: But theſe ſmalleſt ſanguiferous arteries are ſtill the largeſt among the ſmaller or decreaſing ſeries of thoſe veſſels. But we proved before, that a true ſanguine inflammation might be alſo ſeated in the ſerous and in the lympathic arteries: Will it therefore any longer ſeem ſurprizing that the ſolid ſtamina, or threads of thoſe ſmall veſſels ſhould be thus diſſolved and mixed with the fluids ſo as to diſappear? We ſometimes obſerve in conſumptive people, that the whole ſubſtance of the lungs has been ſpit up in the form of matter, inſomuch, that upon opening the body after death, the phyſicians have with good reaſon wondered how life could be continued ſo long with ſo ſmall a part only of this important viſcus remaining.

That fluid which is formed of the extravaſated humours, and tender ſolids combined together, and mixed by attrition, is called pus or matter; which when laudable, or formed by a perfect maturation after an irreſolvable inflammation, has the following conditions: namely, it appears white, and almoſt of the thickneſs of cream, unctuous to the touch, and uniform in every particle, without any manner of foreign ſubſtance. But when matter has not theſe conditions, it is ſaid to be bad. All this has been remarked by Hippocrates [c], in his prognoſtics, where he ſays: *Pus autem optimum eſt album, & æquale, & læve, & minime fœtidum: quod autem maxime huic contrarium eſt, peſſimum eſt*; "But the beſt matter is "white, uniform, ſmooth, and the leaſt fœtid; but "matter which is the moſt contrary to this, is of the "worſt kind." And thus Celſus [d], in treating of what is diſcharged from the wounds and ulcers; namely concerning blood, foul matter, and ichor, *&c.* ſays: *Pus inter hæc optimum eſt. Sed id quoque pejus eſt, multum tenue, dilutum; magiſque, ſi ab initio tale eſt: itemque ſi colore ſero ſimile, ſi pallidum, ſi lividum,*

[c] Sentent. 42. Charter. Tom. VIII pag. 617. [d] Lib. V. cap. 26. n. 20. pag. 289.

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ſi fœculentum. Præter hæc ſi male olet; niſi tamen locus hunc odorem excitat. Melius eſt, quo minus eſt, quo craſſius, quo albidius: itemque ſi læve eſt, ſi nihil olet, ſi æquale eſt; "Among theſe, pus or matter is "the beſt. But of this the worſt kind is that "which is very thin and dilute; eſpecially if it "was ſo from the beginning: and it is alſo bad, "when the colour of it is like ſerum, pale, li-"vid or fœculent. To which add an ill ſmell, ex-"cept it is derived from the part. The matter is "the better, as it is leſs in quantity, thicker and "whiter; appearing alſo ſmooth and uniform, with-"out any ſmell." A little afterwards he well obſerves, that the matter being formed, terminates the inflammation: for he ſays, *Modo tamen convenire & magnitudini vulneris & tempori debet. Nam plus ex majore, plus nondum ſolutis inflammationibus naturaliter fertur*, "That the matter ought alſo to be agreeable "to the magnitude and the age of the wound; for "more matter is naturally diſcharged from a larger "wound, and more before the inflammation is gone "off." Now when the inflammatory matter is too ſtubborn or compact to be digeſted into pus; or when the concocting powers are weaker than is neceſſary for that purpoſe, or when both of theſe concur together; then there is not a matter formed as above conditioned, but the fluid produced deviates more or leſs from thoſe conditions, as Galen[e] well obſerves, in his explanation of the text of Hippocrates laſt cited. For after having ſaid, that the blood is transfuſed in a phlegmon into the void ſpaces near the veſſels (that is into the cellular membrane,) he ſays it cannot then return to its former ſtate, but will change and putrify in the ſame manner as all other juices do, which are violently heated in ſome foreign part; and he then adds: *Itaque ſi innatus calor a propria temperie plurimum receſſerit, ſanguis, ut in cadavere, putreſcit. Si autem ille adhuc aliquam vim retinet, mixta quædam*

[e] Comment. 1. in prognoſt. Hip. Charter. Tom. VIII. pag. 618.

ſanguinis mutatio fit; *partim quidem ab ea, quæ præter naturam, partim vero ab illa, quæ ſecundum naturam cauſa eſt*; *quarum ut illa, quæ præter naturam eſt, putrefacit*; *ſic illa, quæ ſecundum naturam eſt, cauſa concoquit. Earum vero utravis prævaluerit, protinus indicia, tum in colore, tum in odore, tum in conſiſtentia, neceſſaria conſequuntur*; "So that if the innate heat "is too low, or deviates much from its proper tem- "perature, the blood then putrefies as in a dead "body. But if it as yet retains ſome force, the "blood then undergoes a kind of mixed alteration, "partly from the deficiency of nature, and partly "from that power which ſhe yet retains; and there- "fore there follows a putrefaction of that which is "preternatural, and a concoction of that which is "agreeable to nature. But which of theſe condi- "tions prevails moſt, may be known from the ne- "ceſſary conſequences or ſigns which immediately ap- "pear both in the warmth, in the ſmell, and in the "conſiſtence of the matter."

The formation of matter therefore depends on, or reſults from the remaining health; whence it is juſtly reckoned by Hippocrates [f] among the worſt ſigns of diſeaſes, for an ulcer to become dry, and diſcharge no more matter either before or in a diſeaſe; for he pronounces that ſuch a patient cannot long ſurvive.

But that the inflamed part tends to ſuppuration, is known from the following circumſtances.

If the circulating humour is mild.] For if there is any conſiderable acrimony in the humours, it will be ſtill much more increaſed by the ſtagnation and greater heat of the inflamed part; from whence would follow an eroſion and deſtruction of the veſſels, inſtead of that mild ſuppuration of their obſtructed ends only, which happens in a ſuppuration.

[f] Hippoc. prognoſt. Sentent. 22. Charter. Tom. VIII. pag. 605. & Coac. prænot. n. 496.

Its motion ſwift.] In the reſolution of an inflammation, a ſedate motion of the humours is equally neceſſary with their mildneſs; but when a ſuppuration follows, there is always a greater velocity of the circulation: Whence a ſuppuration ſeems to be a ſort of medium betwixt a reſolution and a gangrene. In a reſolution, the concreted or ſtagnating humours are removed and reduced to their former ſtate of fluidity; without offering any further injury to the veſſels, or making any evacuation of the impervious juices: but in a gangrene, there is a true death of the inflamed part, which muſt therefore be ſeparated afterwards from the adjacent living veſſels. Now, in a ſuppuration, the ends only of the obſtructed veſſels are ſeparated or thruſt off, and mixing with the extravaſated humours, are formed into matter, under which appearance they are to be diſcharged; and in this a ſuppuration differs from a reſolution; but from a gangrene it differs, in as much as a ſuppuration does not deſtroy all the parts affected. Hence, therefore, the particular velocity of the humours through the part, as well as that of the whole maſs in general, which accompanies an inflammation, ought to be very ſedate, to afford any hopes of obtaining a reſolution: and, on the contrary, it is evident, that if a violent fever attends, a gangrene muſt ſoon follow; but if the motion is not ſo ſedate as in a reſolution, nor yet ſo ſwift as is uſual in a gangrene, the inflammation muſt then terminate in an abſceſs or ſuppuration. When there are no hopes of obtaining a reſolution, it may be as pernicious to leſſen the fever too much, as to imprudently render it more violent; as will appear more evidently hereafter, in the commentary on § 403. numb. 3.

The obſtruction large, &c.] In what reſpect an obſtruction is to be termed large or ſmall, as alſo what ſigns there are denoting its reſolution, has been already declared under the preceding aphoriſm. But an inflammation is principally known to tend to a

ſuppuration by the increaſing of the tumour, heat, pain, redneſs, and other ſymptoms enumerated in the aphoriſms here cited; but theſe ought not to increaſe very ſuddenly, for then they rather threaten a gangrene, but they ſhould rather make a conſtant and gradual increaſe. It would perhaps be a difficult matter to know exactly the bounds, where the poſſibility of a reſolution terminates, and where an incipient ſuppuration begins; but this is certain, that the pain, pulſation, fever, heat, *&c.* do manifeſtly increaſe at the time when the inflamed part ſuppurates. But when the ſuppuration is finiſhed, all thoſe ſymptoms are again diminiſhed, as Hippocrates [g] very well obſerves, where he ſays: *Circa puris generationes dolores & febres magis accidunt, quam pure facto*; "That the "pain and fever are more intenſe about the time of "the formation of matter, that when the matter is "quite formed." Nor is this at all ſurprizing, ſince the diſtended veſſels muſt excite the moſt acute pain at the time when they are neareſt to a rupture; but when they are once broke, the pain thence ariſing immediately ceaſes. See § 221.

SECT. CCCLXXXVIII.

IF the humour is acrimonious, violently moved, the obſtruction large, and the veſſels rigid, then all the ſymptoms (382, 386, 387) are violent; and the ſmall veſſels ſuddenly burſting open, their juices become putrified; hence an ichor is extravaſated and collected like the waſhings of fleſh in bliſters under the cuticle, or elſe there appears a yellow, pale, aſh-coloured, brown, or black coloured foul matter: in the mean time, the redneſs, pain, heat, pulſation, and tumour leave the affected parts, and invade thoſe which are adja-

[g] Aphor. 47. Sect. 2. Charter. Tom. IX. pag. 85.

cent,

cent, whereupon follows a death of the part affected, which is termed a *gangrene*; being the third manner in which an inflammation ſometimes terminates.

We come now to the third manner in which an inflammation terminates, which is called *a gangrene*. When the vital circulation of the humours through the arteries and veins is from any cauſe deſtroyed in ſome ſoft part of the body, it occaſions a death of that part; which while beginning and performing, is termed a gangrene. Therefore this manner of terminating an inflammation differs from a ſuppuration, in as much as all the motion of the humours is intirely deſtroyed in the affected part, by a ſudden rupture of its ſmall veſſels; whereas in a ſuppuration, only the extremities of thoſe veſſels are gradually ſeparated, by the motion of the vital humours urging behind. But an inflammation more eſpecially tends to a gangrene, when attended with the following circumſtances.

If the humour is acrimonious.] Any very ſharp ſubſtance or liquor applied externally to the body, cauſes a gangrene, whether it be acid, alcaline, or of any other ſpecies of acrimony. For thus true gangrenous eſchars are formed, by touching the ſkin either with oil of vitriol, the potential cautery of the ſurgeons (formed of a ſharp alcaline ſalt, boiled up with quick lime) the acrid empyreumatic oils of hartſhorn, of lignum guaicum, the volatile alcaline ſalts, *&c.* and the ſame thing alſo happens when the maſs of blood itſelf is infected with acrimonious particles. It is indeed true, that theſe acrimonious particles cannot eaſily enter into the blood; and yet we obſerve in diſeaſes, that the humours often degenerate ſurprizingly into an acrid ſtate, by which the ſoft parts are often ſuddenly corroded and deſtroyed. In the worſt ſpecies of the ſcurvy the gums are often de-

ſtroyed by a true gangrene or putrefaction, with an intolerable ſmell; and the moſt malignant ulcers, ſuddenly tending to a gangrene, ariſe in various parts of the body and eſpecially in the legs. And the like diſaſters are alſo obſerved to follow from a turgeſcence of the veſſels with atra-bilis joined with a violent motion, as we ſhall explain more at large in § 1104. From whence it is evident, that if a conſiderable acrimony of the blood is alſo accompanied with an inflammatory ſpiſſitude or tenacity, that then the veſſels muſt be ſuddenly deſtroyed, and a gangrene produced.

Violently moved.] We have already ſeen, that a ſedate motion of the humours favours the reſolution of an inflammation, and that a motion more ſtrong or ſwift alſo promotes a ſuppuration; but a motion ſtill more violent will act ſo forcible upon the obſtructed ends of the ſmall arteries, as to break them all open ſuddenly, and not produce a gradual ſeparation of them, as is done in a ſuppuration. But a ſwift motion of the circulating humours throughout the whole body, is known by the quickneſs of the pulſe, and frequency of the reſpiration; while the moſt intenſe pain and heat alſo denote the ſame thing in the inflamed part. If then an acrimony of the humours be added to their increaſed motion, it is very evident, that theſe very fine veſſels muſt be very ſpeedily deſtroyed; ſince the humours are in this caſe applied not only with an acrid or diſſolving power, but alſo with a greater impetus, and oftner in a given time. It was alſo demonſtrated in the commentary on § 100. that a bare increaſe of the circulation, renders the ſalts and oils of the blood more acrimonious; and from hence again will ariſe a new ſtimulus, increaſing the velocity of the circulation, ſo as to be ſtill more productive of itſelf. From all which it is ſufficiently apparent, what danger an inflamed part is in, when there is a violent fever attends.

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The veſſels rigid.] It was demonſtrated in the commentaries on § 52. that an increaſed rigidity or too great a ſtrength of the veſſels rendered the blood very thick or compact, and diſſipated its more fluid parts, by which means it became more inclined to concretion. And we lately obſerved (§ 386.) that a mobility of the flexible veſſels, and a diluting vehicle, are two of the chief means from whence we are to expect that inflammation may be reſolved: and therefore if the contrary of theſe take place, they will be always followed with more fatal conſequences. As in this caſe the humours move through the veſſels with a great velocity, their whole impetus will act upon the ends of the obſtructed veſſels, a great part of which impetus would have been otherwiſe ſpent in dilating the ſides of the flexible veſſels; and from hence the ends of the veſſels will be ſuddenly forced or broke off by this greater impulſe or more ſudden action of the humours upon the obſtructed matter; whence will be occaſioned all the conſequences hereafter enumerated. And from hence the reaſon is alſo evident, why inflammatory diſeaſes are generally ſo fatal in people who have been addicted to hard labour.

Then all the ſymptoms are violent.] If the tumour of the inflamed part ſuddenly increaſes, the redneſs becomes intenſe or inclines to a purple, the heat burning, and the pain ſevere or continually increaſing, accompanied with a quick pulſe and a difficult reſpiration, *&c.* a gangrene will then follow in a little time.

The veſſels are ſuddenly broke, *&c.*] If now we conſider that an acrid humour is here violently impelled againſt the ends of the veſſels, ſo obſtructed with impervious matter, that they are quite incapable of tranſmitting any part; it will readily appear, that we ought to expect a ſudden rupture or diſſolution of thoſe veſſels, and this eſpecially if the too great rigidity of the veſſels renders them leſs apt to be diſtend-

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ed without breaking. The veſſels once broke, they extravaſate their juices, which ſpontaneouſly corrupt, and that in a little time, ſince the intenſe heat, which always accompanies a violent inflammation, very much promotes putrefaction, as was ſaid before at § 84. numb. 5. But while all this is performing in the inflamed part, there are certain ſenſible alterations to be obſerved, which teach us, that a gangrene is already preſent, or will very ſuddenly follow. But all theſe appearances are perfectly like thoſe which ariſe from the application of fire to any part of the body, as we obſerved in the commentary on § 370. For then the cuticle begins to ſeparate from the ſubjacent ſkin, and becomes elevated into bliſters by the extravaſated humours, which bliſters are generally filled with a reddiſh coloured ichor, or in a worſe ſtage of the diſorder with a thin yellow matter: hereupon the ſhining redneſs of the part changes into an aſh, pale, brown, or even at length into a black colour; and the diſorder is known to have made a greater or leſs progreſs, in proportion as the colour inclines from that of a pale aſh to blackneſs. Hereupon all the ſymptoms of inflammation diminiſh, and ſometimes they ſeem entirely to diſappear; nor need we wonder at this, ſince the inflammation ariſes from an increaſed velocity of the humours from the vis vitæ which remains. Hence the redneſs diſappears, and the blood is no longer impelled through the veſſels of the part affected; and ſince for the ſame reaſon the nervous fibres of the veſſels are no longer diſtended, the pain alſo ceaſes. Since the heat and pulſation ſuppoſes a violent attrition betwixt the impelled fluid and the ſides of the veſſels, therefore they alſo diſappear when a gangrene follows upon an inflammation; and hence a ſudden ceſſation or remiſſion of the pain and other ſymptoms in acute inflammatory diſeaſes is juſtly eſteemed fatal, if the proper ſigns have not firſt preceded. For when a gangrene ariſes after a violent inflammation in ſome external part of the body, it is

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eaſily apparent from the forementioned ſigns, whether the diſorder is preſent; but when the internal parts of the body ſuffer the like diſorder, a ſudden ceſſation of the pain affords the principal ſign of the gangrene. Thus in the moſt violent pleuriſy, and moſt painful inflammation of the inteſtines, the acute pain often ſuddenly goes off, and the patient periſhes ſoon after he imagined the diſorder to be overcome. Theſe are the fallacious changes in the worſt diſeaſes, which often prove prejudicial to the character of a phyſician; for being thus deceived, he imprudently preſages a happy event of the diſeaſe, which yet proves fatal in a little time.

The veſſels being therefore deſtroyed, all the vital influx and efflux of the humours into the affected part will be aboliſhed, that is, a death of the part follows, and then all the conſequences of a ſpontaneous corruption of the mortified part ſoon follow. If we look into thoſe changes which are made in the fleſh of animals lately killed, and expoſed to a warm air, they will appear to be almoſt the ſame with what we obſerve in gangrenous parts. For the lively red colour of the fleſh begins firſt to diſappear; a pale aſh colour, gradually inclining to brown, ſucceeds; and at length the putrefying fleſh turns almoſt black, and forms a ſtinking matter, which was but a little before ſolid fleſh: but all theſe ſymptoms happen ſooner in the gangrenous part, as the warmth of the adjacent living parts increaſes the putrefaction of thoſe which are mortified.

But the adjacent parts which are not dead, having their humours as yet pervious, thoſe humours will be obſtructed in the borders of thoſe parts which interpoſe between the dead and the living, being incapable to paſs through the part which is already dead: and from hence a new inflammation ariſes as it were round the gangrene, after which a ſuppuration following, the dead or gangrenous parts are ſeparated from the living, or elſe the gangrene ſpreads into the contiguous

tiguous parts by the deſtruction of the vital motion of their humours. But what has deceived ſome unwary phyſicians, is their believing the part to be not yet gangrenous, becauſe there is a pain ſtill perceived in it; though properly ſpeaking there is not any ſenſation in the gangrenous part, but a pain ariſes only in thoſe ſubjacent or ambient parts which are yet living and inflamed. But it is always eſteemed a good ſign if the whole compaſs of the gangrenous part appears red, painful, hot, tenſe, &c. provided the ſymptoms are not ſo violent as to turn the inflammation into a gangrene: for we then know, that the life remaining in the reſt of the body, endeavours to ſeparate the gangrenous or corrupted from the adjacent living parts.

SECT. CCCLXXXIX.

WHEN a part thus affected (388.) is compreſſed externally, or the intenſe heat diſſipates much of the moiſture, then the dead part is indurated and dried up like leather, otherwiſe the ſubjacent parts, being deſtitute of the circulation, corrupt.

Now in the part where the gangrene is ſeated, there is no motion of the humours through the veſſels, but a mere reſt or ſtagnation of them, from whence the ſame changes follow there, as happen from the ſame cauſes in a dead body. The heat of the living ſubjacent parts, being alſo accompanied with a moiſture, converts all that is mortified into a putrid matter; but if their moiſture is exhaled either by intenſe heat or external compreſſion, then the part mortified is dried up and hardened perfectly like a black and dry ſkin or leather, being frequently ſo tough as to be ſcarcely diviſible by a razor. But this is chiefly obſerved in the external parts which are covered with the

the skin; for in other parts the gangrene rather dissolves them into a putrid matter. Thus I saw the intestines were converted into a putrid matter within the space of two days time, in a man who died of an incarcerated rupture, though the man was before in health, and the disease continued for no longer a time. But when a gangrene arises in acute diseases about the os sacrum and coccyx, from the patient's lying too long on his back, there appears then very black and dry spots in the affected skin. But how suddenly a gangrene may arise, and the skin grow black and hard like leather even in an healthy person, barely by an external compression, may be learned from the following accident. While two carpenters were preparing the vast body of a tree, in order to make it into the axis of a mill, in turning it round, it unfortunately happened to give way while it was elevated by the hand-spikes, and by its weight it threw both the men into the adjacent pit, where one of them was instantly pressed to death by the weight of it, and the other was obliged to sustain the weight of it, for above half an hour lying upon the spine of the tibia of his left leg. By good luck the bottom of the pit was covered with a good deal of soft mud, which prevented the pressure from doing so much injury as it otherwise might; so that the man returned home joyfully without being much damaged, being able to stand and walk upon his legs for above a quarter of an hour without detriment: but I being called on the next day found many large and small black spots in the anterior part of the leg, where the os tibiæ has its surface covered almost with nothing but the integuments, and these spots resembled a withering or deadness arising from contusion; but after a more strict examination the skin of those parts appeared very black and hard like leather. For the rough surface of the beam had so compressed the skin by its weight against the subjacent bone, that it became quite destitute of all the vital influx and efflux

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of its humours; and afterwards all thoſe dead parts were ſeparated by a ſuppuration formed all round their margins. Here I had a fair opportunity of ſeeing what a bare compreſſion was capable of effecting, and of ſeeing the reaſon why thoſe parts of the ſkin ſo ſoon mortify ſometimes in diſeaſes, upon which almoſt the whole weight of the body is ſupported when a perſon lies long in bed. But when this hard part of the ſkin like leather is preſſed againſt the ſubjacent living parts, they are inflamed, ſo much tumified, and likewiſe compreſſed, (if the horny matter cannot be ſeparated from the living parts to which it adheres,) that the diſorder by that means ſpreads itſelf deeper.

SECT. CCCXC.

THIS change of an inflammation into a gangrene (388) is ſpeedily promoted by the uſe of every thing which is actually or potentially cold, which aſtringe, coagulate, or repel; alſo ſuch as are fat and acrimonious, emplaſtic or narcotic, ſtrong ligatures or an external compreſſion.

This aphoriſm enumerates thoſe things, which, being applied to the inflamed parts, are found to cauſe a ſudden change of an inflammation into a gangrene.

Things actually or potentially cold.] Among thoſe cauſes, which diſpoſed an inflammation to turn to a gangrene, we enumerated a large obſtruction and a rigidity of the veſſels, ſee § 388. but the effects of cold are a greater contraction and ſtrength of the ſolids, and to increaſe the impervioufneſs of the fluids. The moſt intenſe cold will therefore quite intercept the circulation of the humours by congealing them and by contracting the veſſels; whence a ſudden mortification of a part often follows from a ſevere froſt: but when the vis vitæ is capable of removing the ob-

ſtructions in the frigid part, then an intenſe heat ariſes from an attrition of the more condenſed humours through their contracted veſſels; which laſt is a thing frequently experienced by thoſe who have been rubbing their hands with ſnow, when the uneaſy ſenſe of cold is ſoon followed with an intenſe heat. From hence it is evident, that the application of cold things to an inflamed part muſt be prejudicial, inaſmuch as they either totally intercept the circulation, or inaſmuch as they excite a more intenſe heat afterwards in the parts which are already too hot. But ſometimes the application of cold things may be ſerviceable, when the groſſer parts of the humours have entered the ſmaller veſſels by an error of place, as the veſſels, being contracted by the cold, may repel the matter back into the larger branches; and this more eſpecially when the diſorder is ſeated in the thinner humours, ſince the red part of the blood immediately congeals in cold water, but the ſerum and thinner lymph does not. But it is eaſily apparent, that no good can be expected from the application of cold things, when the diſorder is recent and at the ſame time mild; for if the obſtructing matter of the inflammation is ſo impacted in the ſmalleſt extremities of the veſſels as to be quite ſtagnant, the diſorder will be then rather increaſed. But all this is exactly agreeable with the doctrine of the antients. Thus Hippocrates [a], after having in two places obſerved, that cold, among other evils, produces gangrenes or blackneſſes, (μελασμὲς) he ſoon afterwards adds, that it may be ſometimes ſerviceable, and enumerates the uſes of cold things: [b] *ſi inflammationes & ardores in rubrum & ſubcruentum vergant ex recenti ſanguine. Inveteratas enim (inflammationes) denigrat. Et eryſipelas non ulceratum juvat, ulceratum vero lædit*; "That "they may be ſerviceable when inflammations and "heats incline to a red or blood colour from recent

[a] Aphor. 17. & 20. Sect. V. Charter. Tom. IX. pag. 204, 205.
[b] Ibid. Aphor. 23. pag. 208.

"blood.

" blood. But cold turns inveterate inflammations to " a gangrene or blackneſs. It is alſo ſerviceable in an " eryſipelas which is not ulcerated; but it injures one " which is ulcerated." And though Galen [c] recommends the uſe of coolers in a phlegmon, he yet adds ſome good cautions, when he ſays, *Magiſque profecto ad incipientes phlegmonas frigidis & adſtringentibus, quam diſcutientibus, eſt utendum: atque etiam magis, ubi craſſum non eſt, quod confluit. Vehementi enim in parte inflammata incuneatione (σφηνώσεως) facta, non eſt amplius repercutientibus utendum, ſed tunc tempeſtivum eſt diſcutere*; " And in truth coolers and aſtringents are ra- " ther to be uſed to incipient phlegmons than diſcu- " tients; and this more eſpecially when the obſtruct- " ed matter is not groſs or thick: for when the ob- " ſtructing matter is wedged into the veſſels of a " part violently inflamed, there is no more opportu- " nity to uſe repellents, but then it is time to pro- " cure a diſcuſſion." They certainly could not have ſaid better if they had underſtood the nature of an inflammation from the preſent known laws of the circulation. And in another place, in treating on the cure of an eryſipelas, Galen obſerves [d], that this diſorder requires more cooling than a phlegmon; and then he adds, *Eſto autem refrigerationis terminus coloris mutatio. Etenim exquiſitum eryſipelas ſtatim cum hac quieſcit: non exquiſitum vero, ſed quodammodo phlegmonodes, ſi pluſculum refrigeris, lividam cutim facit. Si ne ſic quidem quis deſiſtat, nigreſcit, & potiſſimum in ſenilibus corporibus: ſic ut quædam ita refrigeratorum ne quidem diſcutientibus medicamentis perfecte ſanentur, ſed relinquant ſcirrhoſum quemdam tumorem in parte, &c.* " But let the uſe of coolers be determined by the " change of colour in the part: for by this means a " true eryſipelas ſoon goes off; but it is not ſo if you " cool a little too much, ſo as to make the ſkin li- " vid in an eryſipelas which is not a true one, but in

[c] Galen. Meth. Med. Lib. XIII. cap. 6. Charter. Tom. X. pag. 301.
[d] Ibid. Lib. XIV. cap. 3. Ibid. pag. 320.

" ſome

" ſome meaſure phlegmonode. For if a perſon does " not then deſiſt, the part turns black, and this eſpe- " cially in old people: inſomuch that the parts, which " have been thus refrigerated, cannot be then perfect- " ly cured, even by the uſe of diſcutient medicines, " without leaving a kind of ſcirrhous tumour be- " hind," &c. From whence it is ſufficiently evident how precarious and uncertain it is to uſe coolers for the cure of inflammations, ſince they are by that means ſo eaſily converted into worſe diſeaſes, if they are not uſed in the very beginning of the diſeaſe, or in thoſe caſes where the inflammation ariſes from an error of place, not of the red blood, but of the thinner humors; as for inſtance in the eryſipelas, the œdema callidum, and the like.

potentia

Things called actually cold are thoſe which remove or diminiſh the heat of an healthy body to which they are applied, even though the things themſelves were actually warm, or at leaſt not much colder than the part itſelf of the body to which they are applied. They are therefore ſuch things as either diminiſh or totally remove the cauſes of heat in the part. But heat ariſes from the motion of the fluids through the veſſels; which motion being diminiſhed, the heat decreaſes, and the reverſe: whence it is evident that thoſe things are ſaid to be potentially cold, which either remove or diminiſh the ſtrength and velocity of the circulation. Thus warm water applied to an inflamed part may remove or diminiſh the too intenſe heat, by relaxing the veſſels, and diluting the obſtructing particles: from whence it may be ſaid to be potentially cooling, notwithſtanding it is actually warm. But it is very evident, that theſe and the like potentially cooling remedies are ſeldom prejudicial to inflammations; as will be ſtill more evident, when we come to the cure of an inflammation. For theſe laſt do not deſtroy the motion of the humours through the veſſels, but they reſtore the equality of the circulation by removing the obſtructions; whereas

thoſe, which cool by intercepting the vital circulation, are highly pernicious, which we are told are the conſequence of ſome poiſons. Thus when Socrates had drank the juice of the cicuta, he felt his legs grow cold, and that coldneſs aſcending above the pubes, he preſently expired.

Which aſtringe or coagulate.] For by theſe the capacity of the veſſels is diminiſhed, and their humours are rendered impervious; both which conſequences tend to increaſe the cauſes of the obſtruction; they therefore deſtroy the free motion of the fluids through their veſſels, which when totally aboliſhed, forms a preſent gangrene in the part.

Repel.] The inflamed part tumifies, and that often to a great degree, for the reaſons before mentioned at § 382. numb. 1, 2. from whence the antient phyſicians concluded, that a matter was here accumulated, which was not there before, and which muſt therefore have been derived from other parts. Now as they obſerved that this accumulation was often made very ſuddenly, they judged it aroſe from an afflux of humours; and therefore placed the cure of the diſorder in repelling them, eſpecially towards the beginning of the diſeaſe, as was a little before proved under the ſame aphoriſm in the paſſage quoted from Galen. That ſuch a repulſion of the blood from the ends of the arteries towards their baſes is practicable, is evident from the moſt certain obſervations. The moſt healthy perſon, who is ſuddenly ſtruck with fear, has inſtantly a paleneſs of his face and lips, which denotes that the red blood is repelled towards the heart and larger veſſels; and therefore a palpitation of the heart with anxiety ſoon follow this paleneſs. The ſame alſo manifeſtly happens when a perſon faints away. But the particles of the blood, which are repelled in theſe caſes, may be alſo repelled from the ſmaller into the larger veſſels by the ſame action when they have miſtaken their courſe, and thus may the obſtruction be reſolved. But how far this may be ſerviceable,

ſerviceable, was declared a little before, when we treated of the application of coolers to inflamed parts: but as all thoſe things, which are externally applied to cauſe this repulſion, act by contracting the veſſels, it is very evident that their uſe muſt be dangerous, except in the beginning of an inflammation ariſing from an error of place; and that therefore if they do not immediately prove ſerviceable, the diſorder will by that means be increaſed.

Such as are fat and acrimonious, or emplaſtic.] Concerning theſe ſee what has been ſaid in the commentaries on § 376. For ſince theſe are of themſelves ſufficient to produce an inflammation, they will doubtleſs increaſe an inflammation ariſing from other cauſes, eſpecially if they adhere to the affected part by an emplaſtic tenacity; for then they render the part affected leſs perſpirable, and the mixt acrimony will remain a long time fixed to the part.

Narcotic.] Theſe perhaps are in their own nature not ſo much to be condemned, eſpecially if they are prudently applied. But as all theſe only obtund the ſenſe of pain, leaving its cauſe remaining; therefore the inflammation often increaſes every minute, and a gangrene follows by a deſtruction of the veſſels, without giving us any intelligence by the ſenſe of pain. But an acute pain, heat, pulſation, and the other ſymptoms ſufficiently advertiſe both the patient and the phyſician of the ill conſequences which are to be feared or expected, unleſs they are deceived by removing the ſenſe of pain by the uſe of narcotics; whence in ſuch a caſe the moſt efficacious remedies are neglected, which might have prevented this termination of the inflammation in a gangrene.

Strong ligatures.] In what manner a gangrene may ariſe from hence, has been declared in the commentaries on § 355. But it is very evident, that if a part already inflamed is compreſſed by a ſtrong ligature, the ſame diſaſter is to be expected much ſooner.

An external compreſſure.] Of this we treated under the preceding aphoriſm.

SECT. CCCXCI.

AND all theſe cauſes likewiſe haſten a gangrene into a ſphacelus.

It was demonſtrated in the commentaries on § 374. that a true phlegmon is moſt frequently ſeated in the cellular membrane, which it ſometimes diſtends to an immenſe bulk: inſomuch that the thin cellular membrane upon the back of the hand is ſometimes ſwelled to the thickneſs of two or three inches above the reſt of the ſkin. When therefore a gangrene follows an inflammation ſeated in this part, the whole corrupted maſs muſt be afterwards ſeparated. And it is no uncommon thing for one to be able to enter the ſcalpel to a conſiderable depth without any ſenſe of it, which might occaſion one to believe that all the ſubjacent parts are dead. But it very frequently happens, that the ſubjacent tendons and muſcles are living nevertheleſs: and then the gangrene is not yet become a ſphacelus: for in this laſt diſorder all the incumbent parts are mortified even to the bone, as we ſhall declare hereafter in the commentary on § 429. But when the panniculus adipoſus is ſo much diſtended, already invaded with a gangrene, and in the mean time confined by the tough ſkin, it will compreſs all the ſubjacent parts, and therefore the vital circulation may be hence intercepted even in theſe; and then the gangrene paſſes into a ſphacelus or perfect mortification of the part. Every thing therefore which has been enumerated in the preceding aphoriſm, as capable of turning an inflammation into a gangrene, may alſo increaſe a gangrene, ſo as to become a ſphacelus.

SECT.

SECT. CCCXCII.

If the inflamed part is glandular, the internal or external heat great, the obſtructing matter thick and inactive by obſtructing the emunctories of the glands, and by diſtending their follicles or cells, and their ſides or membranes, it produces a hard indolent tumour of a gland, which is called a *ſcirrhus*, and is the fourth manner in which an inflammation terminates.

We come now to the laſt way of terminating an inflammation; namely, when an inflammation is not reſolved, nor the obſtructed parts ſeparated from thoſe adjacent which are ſound: in which caſe therefore the morbid will remain united to the ſound parts in ſuch a manner, that no future endeavour of nature, nor any of the preſent known aſſiſtances of art, can diſſolve it; but it can be no otherwiſe removed, than by the knife or by fire. But in thoſe parts of the body, in which the blood paſſes every moment with a rapid motion through the veſſels, it is evident, that the obſtructed matter cannot long remain without ſome alteration: for by this continual ſtruggle betwixt the impulſe of the blood and the re-action of the veſſels, either the obſtructing matter will be removed, digeſted into laudable matter by ſuppuration, or elſe corrupted in a little time ſo as to form a gangrene or a ſphacelus. But when ſuch is the ſtructure of the affected part, that the arterial blood paſſes through its veſſels with little or no force, then there is danger leſt the obſtructing matter, being gradually deprived of its more fluid parts, will remain there immoveable, and form a hard indolent tumour which we call a ſcirrhus. But this way of terminating an inflammation is moſt frequently obſerved in the glandular parts, whoſe emiſſaries or excretory ducts being

obſtructed, none of the ſecerned juices ſeparated by the fabric of the gland, can eſcape, and theſe therefore being accumulated and inſpiſſated by ſtagnating in the cavities, or in the vaſcular compages, will fill and diſtend them: and as the circulating humours cannot here exert their impulſe upon this impacted matter, it will there remain deprived of its more fluid parts, and form an induration or ſcirrhus, of which we have a notable inſtance in an inflammation of the breaſt. For the milk ſeparated from the blood, brought by the mamillary arteries, and ſtagnating in the lactiferous ducts, begins to coagulate; in the mean time the thin ſerum diſtils from the ducts of the nipple, and the reſiduum remains inſpiſſated, and in a manner out of the courſe of the circulation; whence after the inflammation is gone off, ſuch a hard indolent tumour often remains, during the reſt of the patient's life. From hence likewiſe a ſcirrhus of the teſticles often follows, after an inflammation of them: for if we conſider that the very ſmall ſpermatic artery, which ariſes from the trunk of the aorta, ſends out ſmall branches, which communicate and tranſmit the red parts of their blood by real anaſtomoſes into ſimilar ſmall veins, and then ſpends itſelf in an infinite number of convoluted ſmall branches placed orderly, and compoſing the ſubſtance of the teſticle; it will evidently appear from thence, that the impulſe of the arterial blood upon the obſtructed veſſels, is here little or nothing; whence the obſtructing matter being once impacted or fixed in theſe glands, it proves very ſtubborn, and forms a tumour inflexible to all means whatever. But a ſcirrhus follows an inflammation in a glandular part, more eſpecially when attended with the following circumſtances.

A great heat whether external or internal.] Women in childbed often commit the cure of their inflamed breaſt to their nurſes, or to ſome old woman, who is often crazy enough; and as they fear nothing more than a ſuppuration, and an opening of the ſuppu-

rated part by the ſurgeon's lancet, they therefore uſe all their endeavours to prevent it. If indeed they endeavoured to diſperſe the inflammation in time by the application of emollient fomentations, they could not be much blamed: but, on the contrary, they, by a dangerous error, expoſe the inflamed breaſt to the heat of a burning coal, or elſe continually foment it with very dry and hot linen cloths, or elſe they apply ſpirit of wine almoſt ſcalding, by which means inſtead of a ſuppuration following, the more fluid parts are exhaled, and the reſt of the matter inſpiſſated into an irreſolvable ſcirrhus; and then the unhappy woman who was ſo much afraid of a ſlight puncture with a ſharp lancet, is frequently obliged afterwards to undergo the very ſevere and dangerous operation of amputating. The ſame diſorder alſo frequently follows from the ſame cauſes, when the inflammation of a glandular part is accompanied with a violent fever.

The obſtructing matter thick and inactive.] Since milk contains ſo large a quantity of a thick cheeſe like craſſamentum, which eaſily ſeparates by ſtagnation from the thinner ſerum by which it was diluted; therefore a ſcirrhus more frequently happens in the breaſt, than in any other part. When the fœculent or groſſer parts of the blood are deprived of their more fluid juices, conſtituting what the antients call atra-bilis, which infects the maſs of humours almoſt with the tenacity of pitch, in that caſe the ſlighteſt obſtruction in glandular parts degenerate into ſcirrhi, as we ſhall declare hereafter in the commentary on § 485.

Obſtructing the emunctories of the glands. &c.] All thoſe juices which have been ſecerned by the fabric of the gland from the affluent blood, ought to be diſcharged through the excretory ducts of each gland for their determinate uſes. If now the diſcharge of the ſecerned juice is by any cauſe obſtructed, it will conſequently be accumulated and diſtend

the follicule or cell in which it was contained; and the moſt fluid parts of that ſecerned humour being either diſſipated or abſorbed, the remainder will be inſpiſſated and rendered impervious. Now the impetus of the circulating humours may very well act upon the veſſels which compoſe the membranes of the diſtended follicule, but not at all upon the matter contained in its cavity; whence it is evident, that the matter will remain there irreſolvable, frequently by any artifice. But the more fluid parts being diſſipated, even the thinneſt of our juices may by ſtagnation concrete in a ſurprizing matter, as we are well aſſured. The bile which ſtagnates in its veſicle, does often thus concrete into ſtones whenever its excretory duct is obſtructed. Even the urine which is more limpid, gives riſe to the ſtone by being too long retained: and it will be made to appear hereafter, in the hiſtory of calculi, that ſuch ſtony concretions are alſo formed ſometimes in the ventricles of the brain, in the cavity of the abdomen, *&c.* which parts are nevertheleſs furniſhed only (in their natural ſtate) with a very thin dew exhaling from the ſmalleſt arteries. The internal ſurface of the noſe in an healthy perſon being well cleanſed, diſcharges a very thin lymph; but after this humour has ſtagnated for ſome time, and exhaled its more ſubtle parts, it then acquires the toughtneſs of a ſkin. Many more inſtances of the ſame nature might be alledged, but theſe are ſufficient to prove, that very thin humours in the body may give riſe to the worſt concretions.

SECT. CCCXCIII.

THE prognoſis of an inflammation is deduced from conſidering its cauſe, part affected, magnitude, depth, violence, the habit of the patient, the ſeveral ſymptoms; and by comparing theſe

theſe with the demonſtrative ſigns, and effects or conſequences of the inflammation.

We have now conſidered the various ſigns and events of a preſent inflammation, and it therefore remains for us in this place, to enquire into its prognoſis which determines the good or bad event which we may reaſonably expect. But in order to know whether an inflammation inclines either to a ſalutary diſperſion, a mild ſuppuration, a gangrene, or a ſcirrhus, we ought to conſider the following particulars.

The cauſe.] Thus, for example, the contagion of the ſmall pox ſo alters the habit of the moſt healthy perſon, that in three days time the whole ſurface of the external ſkin, and often that of the œſophagus, ſtomach, *&c.* is beſet with inflammatory puſtules: but in this caſe a reſolution can never be expected, but a ſuppuration always, or in the worſt ſpecies a true gangrene follows. But from the contagion of the meaſles, the external ſkin is inflamed indeed, but a ſuppuration never follows, and the diſorder terminates in a ſcaling off of the cuticle. All authors who have attended people in the plague, have obſerved that inflammations ariſe in different parts of the body, which are ſometimes ſo ſevere, that the inflamed part is in a few hours time burnt up to a cruſt, which is afterwards ſeparated or caſt off from the other ſound parts by a ſuppuration of matter formed round its circumference. It is therefore apparent, that a very different event of an inflammation is to be expected, according to the variety of cauſes from whence it may ariſe.

Part affected.] Namely as it is more or leſs neceſſary towards life and health. Thus, for inſtance, in the hand, an inflammatory tumour, though violent, may be eaſily ſupported; but if a ſlight inflammation and tumour ſhould be ſeated in the membrane which inveſts the parts about the glottis, or its rima, the patient

tient will then be ſuffocated in a little time. If a phlegmon turns to a gangrene either in the hand or foot, the mortified part may then be ſeparated from that which is living; but if the like diſorder is ſeated in the brain, it is evident there can be little or no hope. But there is not only a more or leſs danger, according to the different nature of the affected part, but alſo the way of terminating an inflammation is alſo very different on the ſame account. In a glandular part there is danger of a ſcirrhus; but in thoſe parts of the body where there is much fat, an inflammation frequently terminates in abſceſſes and fiſtulæ very difficult to cure; as, for inſtance, about the anus, &c.

Magnitude.] For the larger the ſpace which the phlegmon occupies, the more numerous are the obſtructed veſſels, and the greater is the quantity of the impervious fluids in thoſe veſſels: and at the ſame time the velocity of the circulation through the other veſſels which remain pervious, is proportionably more violent, as was obſerved in the commentary on § 382. numb. 8. But all theſe circumſtances are repugnant to thoſe conditions neceſſary for reſolving an inflammation, (ſee § 386.) and therefore a ſuppuration or a gangrene is to be always expected in ſuch a caſe.

Depth.] It was demonſtrated in the commentary on § 374. that almoſt all parts of the body are capable of inflammation, which is in no part more frequently and obſtinately ſeated, than in the tunica adipoſa. Therefore a deep inflammation muſt be either ſeated in this membrane, or in other parts. If it is ſeated in the fat, which inſinuates itſelf very deeply betwixt the muſcles, then the efficacy of external remedies can ſcarcely penetrate ſo far; and if a ſuppuration or a gangrene follows from ſuch an inflammation, it will be very difficult to deterge or cleanſe the parts. But if the inflammation is ſeated in the tendons, muſcles, veſſels, membranes, perioſteum, or in the bones themſelves; it is then evident for the ſame reaſons,

reaſons, that its cure muſt be difficult. But what bad conſequences may follow from an inflammation of the viſcera themſelves, we ſhall hereafter declare, when we come to treat of acute or inflammatory diſeaſes.

Velocity.] While the impervious humours ſtagnate in the impervious veſſels, the blood which is impelled into them by the remaining vis vitæ, produces certain effects, which are alſo at the ſame time the ſigns of inflammation, enumerated in § 382. But if theſe increaſe ſuddenly, if the redneſs, tumour, heat, pain, &c. increaſe in a moment, we may eaſily foreſee that the tender veſſels will be ruptured in a ſhort time, and that we are by no means to expect a reſolution, but a ſpeedy gangrene; (ſee § 386.) and therefore a ſedate motion of the humours is reckoned among thoſe conditions which are required to diſperſe an inflammation; and, on the contrary, a ſwift motion of them denotes a ſuppuration or a gangrene to be at hand.

Habit of the patient.] Every individual perſon has his particular healthy ſtate; and although the diſpoſition of the ſolids and fluids appear very different in two ſeveral people, yet we often ſee that both of them enjoy a perfect ſtate of health; but in ſuch a manner, that one of them is inclined to one ſort of diſeaſes, and the other is more inclined to another ſort of diſeaſes. The ruſtic who has been inured to hard labour can hardly eſcape from a pleuriſy, becauſe his blood is very compact or thick, and his veſſels being rigid, there is little or no hope of obtaining a mild reſolution; but in thoſe who are of a lax and weak habit, ſuch inflammatory diſeaſes are much more eaſily cured. But the morbid as well as the natural habit of the patient makes an inflammation terminate variouſly: thus the cold and phlegmatic are ſeldom troubled with inflammations, which are but ſlight, if they ever invade; but if a putrid ſcurvy ſhould have infected the humours, the leaſt inflammation, or the ſlighteſt

ſlighteſt wound often degenerates into the moſt ſtubborn ulcer, or a gangrene.

Symptoms, &c.] Of theſe we treated at § 382. et ſeq. From conſidering, all which, one may foreſee what event is to be expected from the inflammation, and thus the prognoſis is abſolved.

SECT. CCCXCIV.

IT is alſo apparent that the curative indications will be different according to the different ſtate of the diſorder.

We come now to deduce the curative indications from all that has been ſaid before, in order to direct us to the means proper to remove the known diſorder. But nothing is of more pernicious conſequence in medicine, than to preſcribe a general method of cure to a diſeaſe, without having a regard to the particular ſtate, and various circumſtances of it. Thus in fact we have different diſeaſes which come under the denomination of a pleuriſy; and which though they are alike in their beginning, yet do they often differ widely as they increaſe, and require a very different method of cure. And again the ſame pleuriſy requires to be treated in a different manner at its beginning from what it does when it has continued for ſome days, and afforded manifeſt ſigns of an incipient ſuppuration. There is therefore no general method of cure to be preſcribed to an inflammation, but it requires a different treatment, according as it inclines to terminate in this or that manner. It is indeed true, that an inflammation ought always to be removed if poſſible by a reſolution, when that ſeems practicable; but if, for example, there are ſigns of a gangrene, the only method that remains is to ſeparate the dead from the living parts, by procuring a ſuppuration, to promote which, all the curative

rative intentions are to be directed entirely to that end: and ſo long as there are any hopes of a reſolution, all the endeavours of art are to be uſed to prevent a ſuppuration, eſpecially when the inflammation is ſeated in ſome internal part of the body. It will therefore be proper to conſider theſe four methods of terminating an inflammation ſeparately, and to deſcribe the treatment proper to each. In the firſt place, therefore, we ſhall treat of the cure of an inflammation by a reſolution; that is, by reducing the concreted and ſtagnant matter of the inflammation to a ſtate of fluidity and motion.

SECT. CCCXCV.

FOR if any of the cauſes (375, to 379.) have produced an inflammation (371) in any part (372, 373, 374, 379,) which is attended with the ſymptoms (383, 384,) and primary conditions (386) then the following indications ariſe.

1. To prevent further injury from being offered to the veſſels.
2. To remove that injury which they have already ſuffered.
3. To render and preſerve the obſtructing matter fluid and mild.
4. Or, if that cannot be performed, to repel the matter back into the larger veſſels.

As this diſtinction will be ſo highly uſeful in the cure of a pleuriſy, peripneumony, quinſy, and the like diſeaſes, therefore each of theſe particulars are to be well conſidered.

The condition of the diſeaſe whoſe cure we ſhall preſently deſcribe, is very exactly determined in this text. For from whatever cauſe the inflamma-

tion arises, or whatever part of the body it occupies, whether external or internal, a resolution of it may be always attempted, provided it is recent, and attended with those circumstances which are enumerated in § 336. And thus may the inflammation be terminated, when there is a possibility of performing what is mentioned in the four following numbers.

1. To resolve an inflammation, it is required to reduce the concreted or obstructing matter to a state of fluidity, and reconcile the stagnating humours to their proper motion; as we observed before at § 386. But if the continuity of the vessels is not preserved, the humours extravasated from the broken vessels will necessarily stagnate and corrupt: but in every inflammation there is a tumor from the distention of the vessels, and a pain from the distraction of their fibres, approaching near to a rupture, both which denote that if the same causes continue to act, the vessels will then burst; but when the continuity of the vessels is dissolved, a suppuration follows, or else a gangrene, if that solution of their continuity happens very suddenly. It is therefore evident, that in order to resolve an inflammation, it is necessary to prevent any further injury of the vessels.

2. So long as the inflamed vessels remain entire, their injury consists in too great a dilatation, and a distraction of their sides, by the impulse of the vital humours against the obstructions: if therefore this too great distention of the vessels is removed, this indication will then be satisfied.

But the two preceding curative indications relate to the solids, and those which follow respect the fluids.

3. The concreted or impervious fluid stagnates in the obstructed vessels; and as an inflammation can take place only in the arteries, (see § 371.) the impulse of the humours urging behind, will always drive the obstructing matter further into the narrow parts of the vessels; it is therefore required so to attenuate this matter, as that it may be capable of passing through

through the ſmalleſt extremities of the obſtructed veſſels. But a bare attenuation of the concreted fluid will not ſuffice, unleſs the mild or unacrid ſtate of the humours is alſo preſerved; for concreted blood may indeed be reſolved by a putrefaction, but then it alſo acquires a great acrimony. But an acrimony mixt with the blood which is in this caſe rapidly moved through the tender veſſels, already weakened by too great a diſtention, would deſtroy them in a very little time; whence a gangrene would then follow inſtead of a mild reſolution: for it was demonſtrated in the commentary on § 388. that an acrimony of the humours cauſes an inflammation to tend ſpeedily to a gangrene. It is therefore hence apparent, that the mild ſtate of the humours muſt be preſerved, beſides reducing them to a ſtate of fluidity.

4. Sometimes the orifices of the veſſels are ſo dilated as to admit ſuch groſs particles, that we can ſcarce hope to attenuate them, ſo far as to procure a free paſſage of them through the ſmalleſt extremities of the obſtructed veſſels. Thus the red blood enters the pellucid veſſels, even of the cornea itſelf in the worſt ſpecies of an ophthalmia, whoſe veſſels are much more minute than thoſe of the adnata tunica; but thoſe veſſels in their natural ſtate, will exclude all ſuch parts of the blood as have any colour. So that although the red impervious blood which ſtagnates in theſe veſſels, ſhould be reſolved into ſerum, and that ſerum again into lymph, which is a degree thinner, yet its particles would not be capable of pervading the ſmalleſt extremities of theſe very minute vaſcules. There is therefore but one means left in this caſe to reſolve the inflammation; namely, to repel the obſtructing particles, from the narrow ends of the veſſels into which they are impacted, towards their larger baſes, and from thence into the larger veſſels; ſo that being returned into the circulation, the obſtructing matter may be reſolved by the motion and attrition

trition of the veſſels, and of the other contiguous particles.

SECT. CCCXCVI.

ANY further damage to the veſſels is prevented:

1. By removing or correcting the known cauſes (375 to 380.)

All that art can do in the cure of diſeaſes, is to reſtore the parts to their healthy ſtate; but the cauſes, which are enumerated in the aphoriſms here cited, are ſuch as may cauſe an inflammation even in the moſt healthy perſon; and therefore all endeavours will prove fruitleſs, unleſs theſe cauſes can be removed: as for inſtance, when an inflammation ariſes about the os ſacrum and coccyx, from a perſon's lying too long on his back, it will not be poſſible to prevent that inflammation from turning to a gangrene, unleſs the preſſure of the incumbent weight of the body can be taken off; and the ſame is alſo apparently true with reſpect to the other cauſes of inflammation.

2. By diminiſhing the force of the arterial blood by bleeding and purging.

There are two things which concur in the definition of an inflammation, as explained at § 371. namely a ſtagnation of the arterial blood in the ſmalleſt veſſels, joined with a preſſure and attrition from the reſt of the blood, which is more ſtrongly urged into the obſtructed part by a fever. Now the impervious blood ſtagnating in thoſe veſſels indeed cauſes an obſtruction, but there is from thence no further injury offered to the obſtructed veſſels, if they are not urged or diſtended by the impetus of the blood acting

ing behind. Therefore the chief thing required to prevent the inflamed veſſels from ſuffering any further injury, will be ſo to diminiſh this impetus, as that the veſſels can be neither ruptured nor more diſtended by the arterial blood; whoſe motion cannot be totally removed, and at the ſame time continue life in the part; but yet it may be rendered ſo gentle as to do no further damage. But this is obtained by

Bleeding.] It was ſaid at § 381, that the remaining life produces certain effects in the obſtructed parts, which were at the ſame time the ſigns of an inflammation: but the malignity of an inflammation is to be meaſured by the number and magnitude of theſe effects, which alſo indicate in what manner the inflammation will terminate. When therefore the vis vitæ is diminiſhed or rendered leſs active by any cauſe, thoſe effects, which reſult from the impulſe of the vital humours into the obſtructed veſſels, will be diminiſhed. Now we are capable of diminiſhing the impetus of the blood to any degree which we pleaſe, even until death or a perfect reſt barely by bleeding; and therefore we may reſtrain the force of the circulation more or leſs according to the degree of this evacuation. Helmont[a] and many others after him have baniſhed this waſting of the blood as uſeleſs and pernicious in the cure of inflammatory diſeaſes: for they believed, for inſtance, that a pleuriſy aroſe from an hoſtile acid, fixing itſelf like thorns into the intercoſtal membranes and veſſels: and therefore, cried they, bleeding is to no purpoſe, but we muſt remove the pleuritic ſpiculæ; the bloody Moloch prevailed over the medicinal profeſſors, who then taught that this diſeaſe was to be conquered by ſpecific remedies, and not by weakening the ſtrength with bleeding, *etc.*[b] But it is evident from what has been ſaid before, that theſe pleuritic ſpiculæ are nothing more than the impervious blood heſitating in the ſmall ar-

[a] Helmont. in capit. Pleura furens, pag. 319. n°. 13.
[b] Ibid. pag. 322.

teries, and that the humours, urging on the back of these obstructions, drive in their spiculæ, that is, produce a pain from the distraction of the fibres. It is indeed true, that a perfect cure might be obtained, if the impervious blood, which there hesitates, can be instantly dissolved, and reduced to a state of fluidity: but whether or no Helmont could effect this by his boasted specifics, such as goat's blood dried and reduced to a powder, especially that which was discharged from cutting off the testicles; the stag's pizzle, wild poppy flowers, *etc.* will appear very doubtful to one who reads how little serviceable they proved to himself in the like disease, as he relates towards the end of the same chapter. As therefore there has not been any remedy as yet found, which deserves to be trusted as a specific for resolving immediately the stagnant and impervious blood in this disease, whether externally or internally applied; therefore nothing more useful can be done, than to prevent the further ingress or protrusion of the obstructed matter into the more narrow parts of the converging vessels, and at the same to prevent it from growing more compact and firm: but both these intentions may be obtained by diminishing the force of the arterial blood, which may be most commodiously and safely performed by phlebotomy, as also by

Purging.] For next to bleeding this evacuation most effectually diminishes the force of the blood. In the *materia medica* corresponding to this aphorism, you have a list of those purgatives which act without much increasing the motion of the blood, and which even attenuate or dissolve our humours at the same time. This method is even recommended by Sydenham, who diligently inculcates the same in his *Schedula Monitoria* concerning the coming in of a new fever at that time, which treatise he wrote towards the end of his life, after he had spent thirty years in the practice of physic, and in diligently observing the course of nature in diseases. He there treats of an inflammatory

inflammatory fever, with a ſudden determination of the morbific matter towards the brain: and after premiſing phlebotomy, he preſcribes a purging draught *ex tamarindis, rheo, ſenæ foliis, manna, etc.* and in the evening he gave a gentle paregoric to quiet the diſturbance from the purge, though but ſlight. He repeated ſuch a purge every other day to the third time, and by that means happily cured the diſeaſe, which was of its own nature dangerous enough; but he diligently obſerves, that theſe purgatives were prejudicial, unleſs phlebotomy had been premiſed.

But it is very evident, that all theſe aſſiſtances of art are not required in every inflammation, but only in thoſe caſes, where the continuity of the affected part, being abſolutely neceſſary to life and health, will not admit of any other way of terminating the inflammation; or unleſs the inflammation is ſeated in ſuch a part of the body, as will not admit of diſcharging the matter after a ſuppuration is made, from whence the moſt fatal conſequences might be expected.

3. By diminiſhing the quantity of the humours by the ſame means.

It was ſaid in the commentary on § 378, that one of the moſt frequent cauſes of inflammation was too great a dilatation of the lymphatic arteries, by which they admit groſſer parts of the blood than are able to paſs through their ſmall extremities. Alſo in the commentaries on § 106. numb. 4. and § 118. it was demonſtrated, that a plethora is one of thoſe cauſes, by which the orifices of the veſſels are dilated: ſince therefore bleeding and purging diminiſh the quantity of the humours, they will ſerve to remove thoſe cauſes of inflammation. Beſides this, the quantity of fluids being diminiſhed, there will be a leſs compreſſure and coheſion of the particles of the blood to each other; from which compreſſure the inflammato-

ry ſpiſſitude of the blood very frequently ariſes. For if the blood impelled from the heart was to run into the arteries in an empty ſtate, it would there meet with no reſiſtance, and conſequently could ſuffer no compreſſure: but when the heart forces out its blood into full arteries, thoſe arteries muſt either be dilated, or the blood contained in their cavities muſt be compreſſed, but the arteries reſiſt dilatation the more as they are fuller, and therefore in that caſe the blood will be condenſed or thickened. Therefore for this reaſon an inflammation is juſtly reckoned among the effects of a plethora § 106. numb. 4. and therefore by diminiſhing the quantity of the fluids moving in the veſſels, the body is rendered very much averſe to inflammation; and it rather inclines to an oppoſite diſorder, namely a dropſy, which uſually follows profuſe evacuations.

4. By making a revulſion of the blood's force into other parts by ſuction, friction, ſynapiſms, bliſters, fomentations, warm bathing, iſſues, ſetons, and ſtrong purging of the bowels.

Theſe artifices were conſtantly uſed by the wiſe antients, as appears from the monuments which they have left us. Hippocrates[c], in treating on a quinſy, ſays, *Sic affectis à venis, quæ in brachiis ſunt, ſanguis detrahendus eſt; ſimulque alvus ſubducenda; ut, quod morbum exhibet, id avellatur, etc.* "In thoſe who are "thus affected, blood is to be drawn from the veins "of the arms, and at the ſame time the bowels are "to be looſened or cleanſed, in order to draw off "the matter which cauſes the diſeaſe," *etc.* And thus Galen[d] recommends a revulſion, where he treats of curing the head-ach; *Revulſionem in totum corpus acribus clyſmatibus, et vinculis, ac multis infernarum*

[c] De locis in homine. cap. 11. Charter Tom. VII. pag. 370.
[d] Galen. de Meth. Med. ad Glaucon. Lib. I. cap. 16. Charter. Tom. X pag. 364.

partium

partium frictionibus; sanguinis etiam nonnihil, si ita necessitas urgeat, detrahendo. Parti autem medemur, interim dum in totum corpus revellimus, ea capiti inspergentes, quæ repellendi vim obtinent, etc. "A revulsion is "to be made in the whole body by sharp clysters, li- "gatures, and repeated frictions upon the lower "parts; and also by taking away some blood, when "that shall be found necessary. But in the mean time "we make a partial relief, while we procure the "general revulsion by the asperson of those things "upon the head, which have a repelling force." There are many more passages of the like nature which occur in the same authors, from whence it appears, that they had much confidence in revulsions towards the cure of many diseases. Helmont, who opposes the antients almost in every thing, laughs at these trifles of revulsions; and even since the time of Harvey many have refused their assistance, as being either useless or repugnant to the known circulation of the blood. But the use of revulsions in diseases is confirmed by daily experience as well as by reason; for so soon as the resistance to the blood's motion is either diminished or totally removed in any part of the body, it immediately flows or is derived into that part with a greater velocity. Thus if an artery even but of a moderate size be divided, all the blood will flow through that vessel which does not resist. When all the vessels and viscera of the abdomen are suddenly freed from a considerable pressure by the birth of an infant, all the blood is frequently derived into those vessels so forcibly, that unless the flaccid vessels and viscera are compressed by swathing with a roller, the child-bed woman may suddenly perish in a fatal swoon for want of the blood's due pressure in the vessels of the brain and cerebellum. The same thing also happens if the abdomen is not swathed, when all the water is discharged at once by paracentesis in a dropsy. It is therefore evident, that by diminishing the resistance in any part of the body, the

blood will be derived thither more forcibly and plentifully. But the fulneſs of the veſſels, and the ſtrength of their coats, reſiſt the impulſe of the blood from the heart, which are impediments to their dilatation; and therefore every thing which leſſens the fulneſs of the veſſels, or occaſions their ſides to yield more eaſily to the diſtending blood, will derive the humours more powerfully and copiouſly into that part. If again we conſider, that the blood propelled by the heart is ſent partly upwards to the head, and ſuperior parts of the trunk, and partly downward to the lower extremities and viſcera; it will be from hence evident, that by diminiſhing the reſiſtance of the lower veſſels, or by evacuating them, the quantity and impulſe of the blood will then be derived more towards the inferior parts, and drawn from thoſe which are ſuperior. It is therefore poſſible to make a revulſion of the arterial blood from an inflamed part to any other; eſpecially when the part, towards which the revulſion is made, receives its blood from the ſame common trunks or larger arteries. Thus phyſicians foment the external parts of the head in inflammatory diſorders of the encephalon, that the impulſe of the blood being increaſed in the branches of the external carotide, it may urge with a leſs force upon the parts contained in the head. When the callus of a fractured bone is too luxuriant, (ſee the commentary on § 357.) Celſus tells us, *Quod conferat aliquid de ſinapi cum ficu in alterum pariter membrum impoſitum, donec id paululum erodat, eoque vocet materiam*; "That it will be of ſome ſervice to apply a fig and "muſtard to the oppoſite limb, till it has corroded "the ſame in a ſmall degree, and drawn thither the "matter." But all revulſives either relax the veſſels, or empty them by friction or a more frequent contraction excited in the veſſels by the application of things which ſtimulate upon the part, towards which the revulſion is to be made. But a revulſion is procured chiefly by the following means:

By

By ſuction.] Which is beſt of all made with cupping-glaſſes, by the uſe of which the preſſure of the atmoſphere is removed from the part of the ſkin to which they are applied, or at leaſt its preſſure is by that means conſiderably diminiſhed, whether the air be drawn out by ſucking or by the air-pump, or by much rarefying and expelling a great part of the air contained in the cupping-glaſs by burning flax. So ſoon as the equable preſſure of the air is taken off from the ſurface of the ſkin under the glaſs, all the veſſels are more diſtended, the part ſwells and looks red, and if the glaſſes are continued to be applied for a conſiderable time, a true inflammation may follow, or even a gangrene. Galen [e] has long ago obſerved, that pains are eaſed almoſt as with a charm, by making a revulſion with cupping-glaſſes. Hippocrates [f] has ordered the application of a very large cupping-glaſs to the breaſt to leſſen the menſtrual flux. And I have ſeen violent inflammations of the eyes cured barely by the application of cupping-glaſſes, when ſcarce any other remedies would take any effect. And of what conſiderable uſe cupping was in the like diſeaſes among the Egyptians, may be ſeen in Proſper Alpinus [g].

By friction.] By friction the veins, which yield more eaſily to preſſure, are therefore more eſpecially emptied; whence the arteries, which correſpond to thoſe veins, will more eaſily diſcharge their blood into the emptied veins; therefore the reſiſtance of the blood flowing into thoſe arteries will be diminiſhed: whence it will be derived thither with a greater impetus and in a greater quantity, as is evident from what has been ſaid before. For this reaſon any part of the body may by friction only grow hot, red, and become inflamed; and if the friction is continued, the increaſe of the blood's heat and motion will be com-

[e] Meth. Med. Lib. XII. cap. ult. Charter. Tom. X. pag. 292.
[f] Sect. V. Aphor. 50. Charter. Tom. IX. pag. 224.
[g] De Medicina Ægypt. Lib. II. cap. 14.

municated throughout the whole body: and for this reaſon Celſus[h] condemns friction long continued in acute diſeaſes, when he ſays, *Longa vero frictione uti, neque in acutis morbis, neque increſcentibus convenit; præterquam cum phreneticis ſomnus ea quæritur*; "But "the uſe of long continued frictions is neither pro- "per in acute diſeaſes, nor in thoſe which are in- "creaſing, becauſe it induces both a phrenzy and a "ſleepineſs." And a little after, ſpeaking of the uſe of friction, he ſays, *Nam et capitis longos dolores ipſius frictio levat; non in impetu tamen doloris: et membrum aliquod reſolutum ipſius frictione confirmatur. Longe tamen ſæpius aliud perfricandum eſt, cum aliud dolet: maximeque cum à ſummis, aut à mediis partibus corporis materiam evocare volumus: ideoque extremas partes perfricamus*; "For friction alſo eaſes inveterate "head-achs, but it is not to be applied when the "pain is moſt ſevere: and a paralytic or weak limb "becomes ſtronger by a friction of it. But when "one part aches, it is much more uſual to make the "friction upon another part more remote, and eſpe- "cially when we intend to call off the morbific mat- "ter from the upper or from the middle parts of the "body; for in that caſe we make frictions upon the "extremities."

Synapiſms or epiſpaſtics.] Thus are called thoſe remedies, from their drawing power, becauſe they derive the humours in a greater quantity, and with more force into the parts to which they are applied. Now although every thing, which relaxes and weakens the veſſels in any part of the body, may be termed attractives, becauſe a relaxation of the veſſels gives a more eaſy entrance to the humours; yet by this name we generally underſtand thoſe topical remedies, which irritate the veſſels of the part to which they are applied by an acrid ſtimulus, ſo as to make them contract more frequently and more powerfully, that is, they accelerate the motion of the vital humours

[h] Lib. II. cap. 14. pag. 89.

through

through their veſſels. Theſe attractive remedies have received various denominations, according as they poſſeſs a greater or leſs acrimony. Thoſe which only excite a redneſs in the part to which they are applied, are termed phænigmi; but if they excite a great redneſs with heat, itching, and a tumour in the part, they are uſually called ſynapiſms, becauſe ground muſtard-ſeed, being applied to any part of the body, produces all thoſe appearances: if they are yet more acrimonious, and raiſe the cuticle into bliſters, they are then called veſicatories; or if again they produce the effects of fire upon the part by their ſtrength, they are termed cauſtics. All theſe excite a true inflammation in the part to which they are applied, and if they are very ſtrong, they may increaſe that inflammation even into a gangrene. But what efficacy all theſe have to derive the impetus of the blood towards other parts, is taught by daily obſervation and practice. If the feet of a perſon, who is ill with an acute phrenzy, be involved in a paſte made with ground muſtard-ſeed, ſcrapings of horſe-radiſh, or the like, the diſorder will frequently be relieved in a few hours, and the patient will begin to come to his ſenſes by the pain and inflammation thus produced. When nature endeavours to ſeparate any offenſive matter from the whole maſs of blood, and to depoſit it upon ſome particular part of the body, phyſicians then uſually determine the wandering matter towards a part, where it will be the leaſt offenſive, by applying epiſpaſtics; and this they do often with very good ſucceſs. Thus in the ſmall-pox, when the legs and feet have been fomented with emollient decoctions in the beginning of the diſeaſe, and theſe epiſpaſtics afterwards applied to the ſoles of the feet, I have frequently ſeen, that the puſtules have gathered extremely thick in the lower parts of the body, when at the ſame time there were but very few eruptions in the face and upper limbs.

Veſicatories.]

Veſicatories.] Theſe, as we ſaid before, are yet ſtronger than epiſpaſtics, and ſeparate the cuticle from the ſkin of the part to which they are applied, raiſing it into bliſters, diſtended with a thin liquor, whence they derive their name. Every thing, which can excite the moſt violent inflammation, are alſo veſicatories; for when an inflammation turns to a gangrene, theſe little bliſters of the cuticle afford almoſt the firſt ſign of the incipient gangrene: and in the ſame manner actual fire raiſes the cuticle into bliſters. Hence the moſt acrimonious remedies, ſuch as the ranunculi pratenſes, hydropiper, ſedum minus acre, *etc.* being either applied in too great a quantity, or continued too long upon the part, they raiſe bliſters in the ſkin. But of all this tribe of remedies, cantharides are the moſt frequently in uſe; which dry and juiceleſs inſect I have known to retain its force of bliſtering, though kept in a glaſs negligently ſtopt for the ſpace of above thirty years. Cantharides, being groſsly pulverized, and mixed with ſome ſticking plaiſter, or with ſome dough of which they make bread, and applied to the part towards which the revulſion is to be made, are ſuffered to continue there for the ſpace of eight or ten hours, within which time they uſually elevate the cuticle into a bliſter. But if the cantharides are left too long upon the part, they often excite intolerable pains by irritating that nervous pulp, which lies immediately under the cuticle; and ſometimes they even excite a ſevere ſtrangury and bloody urine.

But as all theſe things have a powerful acrimony, and frequently increaſe the velocity of the blood throughout the whole body, by irritating the part to which they are applied, (which yet is a circumſtance repugnant to the indication in this caſe, as is evident from numb. 2. in this aphoriſm,) therefore great caution is always neceſſary in the uſe of them.

Fomentations and warm bathing.] Theſe are uſually compoſed of water, with the addition of ſuch things

things as are emollient or relaxing. But all of them act by relaxing the ſolids, ſo as to diminiſh the reſiſtance of the veſſels, whereby they will be more eaſily dilated, even though the diſtending cauſe remains the ſame. The moſt efficacious of all theſe are baths of warm vapours; for a part of the body, being expoſed for a quarter of an hour to the vapours of warm water only, begins to ſwell. But when a revulſion is to be made towards ſuch a part of the body, which cannot be conveniently immerged in the bath, fomentations may then ſuffice, provided they are retained warm.

Iſſues.] The ſkin is here divided with a lancet down to the panniculus adipoſus, or elſe corroded by the potential cautery in thoſe who are afraid of the knife. The wound thus made is filled with a little ball of gold, ſilver, ivory, or any other matter which is not eaſily changed, and then covered with a ſticking plaiſter to prevent the globule from ſlipping out of the wound. Thus a foreign body, being interpoſed betwixt the lips of the wound, prevents their concretion, and at the ſame time a ſlight contuſion and irritation is made throughout the whole compaſs of the wound by the hard body, which makes a daily ſlight inflammation in the part, towards which the impulſe of the arterial blood muſt be therefore derived. Theſe iſſues are chiefly ſerviceable to thoſe patients who have their ſolids ſo weak or flexible, that the leaſt exceſs of the blood's impetus dilates their veſſels, which permit the groſſer parts of the blood to miſtake their courſe. Thus, for inſtance, thoſe who have an inflammation of their eyes upon every ſlight occaſion are very frequently relieved by iſſues. But when a violent inflammation ſuddenly invades any part, it is evident enough that iſſues will be uſeleſs; for the part affected may be long corrupted by a gangrene before iſſues can be ſuppoſed to produce any effect. The ſame is alſo true of

Setons.]

Setons.] These are generally placed in the nape of the neck, where the skin and panniculus adiposus being taken up with a pair of plyers for the purpose, the surgeon then perforates them with a large needle, armed with a large thread which he leaves in the wound, and which being daily drawn through the wound, irritates and excites a continual inflammation in the part where the seton is fixed. These are of the same use with issues, but they generally have a more considerable effect, as they produce a greater pain and irritation. I have seen the most obstinate head-achs cured by the revulsion which a seton makes, when they have proved inflexible to all other remedies; and there are many instances which occur in the best authors confirming the same thing. We have a remarkable case of this nature related by Ruysch [h], of a girl eighteen years old, of a sanguine habit, who was continually tormented with an intolerable head-ach. The most efficacious remedies usual in these cases were tried without success, such as purging, repeated phlebotomy, blisters, sternutatories, cupping-glasses. Even a large wound had been made in the integuments of the head by a crucial incision, which was attended with a considerable hæmorrhage, but without success, insomuch that some eminent surgeons had thoughts of trepanning the cranium. But before they proceeded to this last and severe remedy, Ruysch proposed the application of a seton, which being made, the pain presently vanished: and the patient being tired with its troublesomeness, took out the thread, whereupon the pain which had been hitherto dormant, again revived; but a new seton being made, it presently disappeared; but even a third time the seton being healed up, the most troublesome head-ach returned, which again yielded to a new seton.

Strong purging.] How serviceable it is in inflammatory diseases to diminish the quantity and impulse

[h] Observat. Chirurg. n. XL. pag. 39.

of

of the humours by purging, and what purges are proper for that purpose has been already declared at numb. 2. of this aphorism. But it is to be observed, that the same evacuation may be likewise useful as a revulsion, to drive the impetus of the blood from an inflamed part, especially when the disorder is seated in the upper part of the body. For so powerful a derivation may be made through the mesenteric vessels towards the cavity of the intestines, that there hardly remains any pressure of blood in the vessels towards the encephalon; insomuch that the stronger purges frequently occasion a vertigo, and even fainting by this same means. When the whole tunica adnata looks red in an ophthalmia, by the entrance of the red blood into the smaller vessels; in that case, by giving a strong purge, the blood is repelled back into the larger vessels, while a paleness invades the face and eyes, whence a speedy and happy cure is frequently made. Clysters frequently thrown into the bowels do often produce the same effect, partly by relaxing the vessels, and partly by driving the impetus of the humours that way, by a gentle stimulus. Hippocrates[1] treating on the cure of a pain in the ear, after having ordered the application of cupping-glasses on the opposite part, to turn off the afflux, he says: *Si hæc nihil juvent, medicamentum propinandum sit, quod deorsum purget; sursum vero minime, cum vomitus nihil conferat, etc.* "If these avail no-"thing, a medicine is to be given which will purge "downward, but by no means upward, since vomiting "is of no service," *etc.* And a little after, treating of an ophthalmia, he adds: *Si subitissime (oculi) inflammationem conceperint, nihil omnino illine; sed vel fortissime in inferioribus partibus inurito; vel alio quopiam alvum ducente medicamento extenuato; cavendo ne vomitum facias*; "If the eyes are suddenly taken with "an inflammation, do not anoint them with any "thing at all, but make a powerful cauterization in

[1] De locis in homine, cap. 6. Charter. Tom. VII. pag. 361.

"the

" the lower parts, or reduce the habit by giving ſome " other medicine which purges the bowels, taking " care not to make the patient vomit." From whence it is evident, that the ancient phyſicians uſed purges to make a revulſion from inflamed parts, and that the purges were of that nature as to act ſtrongly; ſince Hippocrates in this place uſes the term which denotes an extenuation or waſting of the body, and a collapſion of the veſſels, by a powerful evacuation. But he orders vomiting to be induſtriouſly avoided in theſe caſes, becauſe in the act of vomiting the blood is derived more plentifully and violently towards the head; as is apparent, if a perſon looks at a man while he is vomiting; for the eyes look red and watery, the lips and whole face are diſtended and ſwelled with blood, *etc.*

5. By a dry and cool air, the affections of the mind, being either ſilent or very ſedate; by procuring a natural or artificial reſt to the patient; by uſing a thin, fluid, and cooling diet, with a drink of the like nature, and uſing diluent and cooling medicines at the ſame time.

This number treats of thoſe means by which the motion of the humours through their veſſels may be rendered the more ſedate, in order to hinder any further injury from being offered to the veſſels which are inflamed.

A cool and dry air.] That is cool ſo far as it is received into the lungs in reſpiration. For the blood propelled from the right ventricle of the heart, receives a great heat and attrition from the ſwiftneſs of its motion through the pulmonary artery, and therefore requires to be cooled by the air, as is evident from phyſiology. But if the external air is too hot, it cannot be then expected to cool the blood. Now it appears from experiments made on living

animals, that a moſt acute fever may ariſe, barely for want of this cooling of the blood by the air, which proves fatal in a few minutes time, if the air in which thoſe animals are included is very hot [k]. It is therefore evident, that a cool air conduces much to moderate the ſwiftneſs of the circulation of the blood. But a dry air is to be preferred *(cæteris paribus)* before a moiſt air, which laſt, if cold, may cool the blood too much. For we conſtantly obſerve, that people are ſenſible of a greater cold in autumn or winter, when the air is moiſt, than when it is dry, notwithſtanding the thermometer denotes the ſame degree of heat; which ſeems to follow, becauſe the air which has little or no moiſture, is ſooner heated by the warmth of our bodies: for, in general, it is to be obſerved, that bodies grow hot ſooner or later by the ſame degree of fire, in proportion as they are more or leſs denſe, whether they be ſolids or fluids [l].

The affections of the mind either ſilent or ſedate.] That the circulating motion of the blood may be very much accelerated by violent paſſions in the mind, is evident from daily and certain experience. But of this ſubject we treated in § 99. numb. 1. Whence it is evident, that theſe paſſions ought to be induſtriouſly avoided; or if they ſhould ariſe, they are to be immediately quieted; the manner of effecting which has been ſaid in the commentary on § 104.

By procuring natural or artificial reſt.] How ſerviceable reſt is in all diſeaſes, in which there is too great a velocity in the blood's motion, has been ſaid in the commentary on § 105. But when the mind is not diſcompoſed by any paſſions, and nothing operates ſtrongly upon any of the ſenſitive organs, a quiet ſleep then uſually creeps on of its own accord; for which end the antient phyſicians cauſed their patients to lie in a dark place free from the leaſt noiſe, in all acute or inflam-

[k] H. Boerhaave Chem. Tom. I. pag. 275, &c. [l] Ibid. pag. 279.

matory

matory diſeaſes. But if this reſt cannot be thus procured, after premiſing thoſe means mentioned in the preceding numbers, we may then ſafely apply to the uſe of anodynes. See more on theſe remedies in the commentaries on § 202, and 229. numb. 2.

A thin fluid and cooling diet.] In order to reſtore thoſe parts which are continually waſted from the body, by the unavoidable actions of life and health, it is required of us to be continually taking in aliments at proper intervals; and though theſe aliments are of the beſt nature which we can chooſe, yet they have always ſomething of a foreign diſpoſition, and therefore require to be altered into our own nature by the action of the veſſels and viſcera. But while this attenuation and change is made in our ingeſted aliments, if they are taken either in too large a quantity, or are not eaſily ſuſceptible of that change, they excite a fever even in the moſt healthy people; by which means the inflexible matter which produced the fever, is either attenuated or diſcharged. Even every day the moſt healthy perſon may perceive an increaſe in the quickneſs of the pulſe, ſome hours after dinner. But as thoſe powers which are to change the crude aliments into good blood are weaker, ſo much more is the blood's motion accelerated by the ingeſted aliments. Thus if a weak girl ſhould have dined upon fleſh which has been dried in the ſmoak, upon fat bacon, or food of the like hard digeſtion, ſhe will certainly be feveriſh within a few hours afterwards: and phthiſical people who are gradually waſted by an hectic fever, even theſe perceive an increaſe of their fever, by taking more milk than uſual. But as the aſſimilation of the ingeſted aliments into healthy animal juices, depends chiefly upon the action of the ſolids upon the fluids, and upon a conſiderable quantity of healthy ready formed juices, which are to be gradually mixed by a little at a time with the crude chyle; (ſee the commentary on § 25.) and as by bleeding and purging (preſcribed at numb. 2, and 3.

of

of this aphorism for resolving an inflammation) the ready formed or concocted humours are evacuated, and the force of the circulation diminished; it is therefore evident, that the diet ought to consist of such things only, as are very easily attenuated and digested. Every thing therefore which can be easily changed into good chyle, even by a slight action of the chylificative viscera, and may be afterwards easily attenuated further, so as to form good blood, by the action of the lungs and arteries, will be here convenient: as the whey of milk, especially that sourish kind which is made from butter-milk: milk diluted with two or three times as much water, barley, or oat gruel, *&c.* with the juices lately expressed from garden fruits; these are in this case very useful, especially if taken in small quantities at a time, and frequently repeated: for by such a diet the body will never be oppressed, but will from thence be moderately cooled, which is extremely useful in acute inflammatory diseases. People have even a spontaneous or natural appetite to such cooling and thin aliments, when they are fatigued either with inflammatory diseases, or by the intense summer's heat, and they have an aversion to food of a contrary nature: but, on the other hand, a cooling diet would be directly repugnant in the winter time for chronical and languid diseases. And this doctrine we have expressed by Hippocrates, after his usual manner, in a very few words, when he says: *Imbecilles diætæ frigidæ, valentes vero calidæ*; "That the weak are to "have cooling diet, but those who are strong and well, "a diet that is heating [m].

Drink of the like nature.] The juice of citrons, oranges, cherries, currance, their syrups or inspissated juices, which are prepared by the confectioners, diluted with a large quantity of water, form a very pleasant drink; out of which you may make an agreeable variety, changing the ingredients, from whence those may be selected which are most pleasing to the pa-

[m] Epidem. Lib. VI. textu 18. Charter. Tom. IX pag. 494.

tient, ſince almoſt any thin liquor will ſuffice for this purpoſe.

Uſing medicines which dilute and cool at the ſame time.] We have already ſeen, that the impervious blood ſtagnating in the ſmaller veſſels, ſuffers a compreſſion and attrition from the impulſe of the humours urging behind, as is evident from the definition of an inflammation given in § 371; and we demonſtrated in § 382. numb. 6. that this attrition is followed with an intenſe heat, therefore, to prevent any farther injury to the inflamed veſſels, it will be convenient to uſe ſuch remedies as may diſſolve the obſtructing or concreted matter by diluting, and at the ſame time remove the too great heat which ariſes. But, properly ſpeaking, we have in this caſe but one diluent, namely water; ſince all other medicines are no farther diluents than as they contain water. But we ſaid a little before, that thin and fluid aliments, or rather drinks, are here convenient; that is, as they contain more water, by which they conduce to dilution together with the medicines. But cooling medicines are ſuch as diminiſh or remove the cauſes of too great heat; which too great heat accompanying an inflammation, was demonſtrated (in § 382. numb. 6 and 8.) to ariſe from a greater attrition of the ſolids upon the fluids, and of the fluids upon each other, from an increaſe in the circulation in the inflamed veſſels, as alſo in thoſe veſſels which remain yet pervious, but are more or leſs compreſſed or ſtraitened by the diſtention of the adjacent veſſels which are obſtructed and diſtended. Therefore every medicine will be a cooler, which can remove the too great thickneſs of the fluids; which can relax the obſtructed veſſels, and which can diminiſh the too great impetus of the circulation, and therefore all watery liquors will be ſerviceable not only as diluents, but as coolers at the ſame time. For we obſerve that the habit of body is colder as it contains a larger quantity of water, and, on the contrary, that the blood is hotter as it is leſs dilute:

dilute: Hence all dropſical people are cold, but thoſe who are robuſt, and addicted to exerciſe are very warm. But water is alſo ſerviceable at the ſame time, in as much as it relaxes the ſolid parts, as was ſaid in the commentaries on § 35 and 54. Now the blood being diluted with water, and the veſſels relaxed, the force of the circulation is thereby always diminiſhed, as is very evident in weak girls, who ſo frequently fall into diſeaſes from weakneſs, by the abuſe of warm watery liquors. When therefore there are any hopes of reſolving an inflammation, water is to be the baſis of all the antiphlogiſtic medicines, to which farinaceous and emollient ſubſtances are to be added to relax the veſſels ſtill more; and to theſe, attenuating remedies are likewiſe to be joined, to divide the inflammatory concretions, and render them pervious. Various forms of theſe remedies may be compiled, of which you have ſome ſpecimens given in the materia medica, correſponding to this number of the preſent aphoriſm. It is to be alſo obſerved, that bleeding and purging, of which we treated at numb. 2 and 3, of the preſent ſection, are alſo coolers in inflammatory diſeaſes.

6. By quieting the impetus of the blood in the part itſelf, by the external application of remedies, which cool, repel, and aſtringe; to which may be added anodynes and aperients of various kinds, according to particular circumſtances.

Hitherto we have been treating of thoſe remedies which prevent any further injuries of the veſſels, either by making a change in the whole body, or in ſome other of its parts; we are therefore now to treat of thoſe which are capable of reſtraining the too great impetus of the humours, by an external application to the inflamed part itſelf. It was ſaid before in the

commentary on § 382. numb 8. that the motion of the humours was accelerated, as well by an irritation of the fibres in the inflamed part, as of thoſe throughout the whole body; and therefore every thing which can remove this irritation by being applied to the inflamed part, will reſtrain the impetus of the blood. But this irritation there ariſes, becauſe the ſides of the veſſels are diſtracted by the blood urging behind the obſtructions; and therefore every thing which can remove the obſtructions, and give a free paſſage to the heſitating blood, into the open veſſels, may remove this irritation. But ſuch a paſſage may be procured to the blood two ways, either by ſo relaxing the obſtructed veſſels, that the impervious particles may paſs through the extremities into the veins; or elſe by contracting the veſſels in ſuch a manner by things which cool, repel, and aſtringe, as to drive back the obſtructing matter from the impervious ends of the veſſels towards their larger baſes, or into a larger part of thoſe veſſels. This laſt method was frequently uſed for the cure of inflammations by the antient phyſicians, when any part of the body was ſuddenly inflamed, without any apparent cauſe preceding, in which caſe they derived the cauſe of the diſorder from an afflux of humours: And Galen [n], treating on this diſorder, obſerves, that the methodical ſect of phyſicians, and their followers aſſerted, that all inflammations were to be treated with laxatives, becauſe they judged the diſorder to proceed from an aſtriction. For it is to be obſerved, that this ſect of phyſicians derived all diſorders either from a ſtricture, or a relaxation of the ſolids only, in which doctrine they had afterwards many followers. But a little afterwards Galen adds, that both reaſon and experience teach, that after due evacuations the inflamed part is to be treated with ſuch remedies as have a power of repelling the influent humours, and at the ſame time of evacuating thoſe

[n] Method. Medend. ad Glaucon. Lib. II. cap. 2. Charter. Tom. X. pag. 370.

which

which are already contained in the affected part, and such also as can restore the tone or strength to the affected parts. For these purposes he recommends the sempervivum, malicorium, rhus, &c. in which there is manifestly a power of cooling and astringing. And in the following chapter of the same book, he says, that it will not be improper to apply such things as moisten and warm, to those inflammations which arise from other causes, but which do not proceed suddenly from such an afflux.

From what has been said therefore here, and in the commentary on § 390, where we treated of the effects following from the application of things actually or potentially cold to an inflamed part, it appears that coolers are serviceable with astringents and repellents only at some particular times; and that there is some caution required in their application, since if they do not prove serviceable, they may be very injurious. In the slighter inflammations they are often very serviceable, if applied in the beginning; and thus I have frequently seen incipient inflammations of the eyes cured only by the application of cold water. But when the disorder is inveterate, and the obstructing matter as it were (to use the expression of Galen, cited in § 390.) wedged into the vessels, it will not then suffer itself to be easily repelled; whence the vessels being rather contracted in their capacities by these remedies, and their humours coagulated, the disorder will be increased: and therefore in such a case it will be more proper to apply laxatives and aperients, which open the vessels, and loosen the obstructing matter. It is therefore the business of a prudent physician to vary and chuse his remedies according to particular circumstances.

It likewise seems of service in this case to take in the use of anodynes, or those medicines which ease pain. But these, as we observed in the commentary on § 202. act in a threefold manner; either by removing the cause of the pain, or by so disposing the

part in pain to which they are applied, that it becomes leſs affected by the painful cauſe; or laſtly by removing the ſenſe of pain, while the cauſe of it remains in the injured part. All the remedies therefore before mentioned will be anodynes, inaſmuch as they remove the cauſes of pain, either by relaxing and opening the obſtructed veſſels, or by repelling the impervious matter from the narrower towards the larger part of the veſſels; or which ſo diſpoſe the affected part, that it is leſs injured by theſe cauſes. But beſides theſe we have alſo a licence to uſe thoſe remedies which remove the ſenſe of pain in the part to which they are applied, provided thoſe means are at the ſame time not neglected, which are capable of removing the cauſes of the pain. Hence the leaves of *hyoſciamus*, *cynogloſſæ*, *&c.* may be added to fomentations to be applied to the inflamed parts: for the effects of violent pain are (as we obſerved at § 226.) fever, heat, thirſt, dryneſs, *&c.* all which are injurious to the inflamed parts, and as many of theſe diſorders ariſe only from the ſenſe of the pain, § 229. numb. 2. it is very evident that much good may be therefore expected from the uſe of thoſe remedies which obtund the ſenſe of pain.

SECT. CCCXCVII.

THE injury itſelf, which is offered to the veſſels, is likewiſe removed by the ſame means (396): for thoſe which have been relaxed by too great a diſtraction will recover their former figure by the natural contractile force of the fibres, and their powers and nutrition will return.

The injury offered to the obſtructed veſſels aroſe from their diſtention by the impulſe of the vital humours urging upon the obſtructed part; and as every thing enumerated in the preceding aphoriſm tends either

ther to diminish or to turn off the impulse of the blood, it is very evident, that the injury may be removed by the same means. For so long as there are any hopes of obtaining a resolution, the continuity of the vessels is not yet dissolved, even though they are very much distracted, so that when the obstruction is resolved, the distracted fibres gradually recover their former dimensions, and all the disorder, which then remains, is a weakness of the fibres from their having suffered too great a distraction, (see § 25. numb. 3.) which is cured by removing the distracting causes, (§ 28. numb. 5.) and by restoring the lost strength of the vessels and viscera by suitable aliments. Now the more firm and elastic the vessels are, which have been distended by an inflammation, the sooner do they return to their former shape or dimensions; and on the contrary more time is required to restore the strength of the vessels in proportion as the inflammation is seated in a lesser series of them. Perhaps one may from hence derive the reason of several appearances, which remain a long time after the cure of inflammatory diseases of the encephalon by resolution: for it sometimes happens after a frenzy or a delirium in acute fevers, the small-pox, &c. that a considerable weakness remains, or a notable disturbance of all or some of the functions, which depend upon the encephalon, continues even after these diseases have been cured. If then the cure of them is attempted by blisters, purges, sudorifics, and the like evacuants, or powerful movers of the blood, every thing becomes worse, whereas by committing them to nature, those maladies in time disappear of themselves. The same thing is also confirmed by that most diligent observer of nature in the most abstruse diseases, Sydenham [a]: for he remarks in a continual epidemic fever, which suddenly affected the head with a phrenzy, that after general evacuations made by bleeding and purging, a coma was sometimes left behind,

[a] Schedula Morit. de nova febris ingressu, pag. 661.

which yet disappeared in time, provided the patient arose from his bed daily, and was not molested with violent remedies. For in these cases the equable motion of the humours, through the encephalon, seems to remain disturbed, till the vessels, too much weakened by distention, have recovered their former strength.

SECT. CCCXCVIII.

THE obstructing matter will be reduced to a state of fluidity, if it be attenuated and diluted:

1. By restoring the elastic vibrations of the vessels, by diminishing the distended humours, by plentiful bleeding and purging; by adding a stimulus to the fibres, by means of some thin aromatic liquor drank very warm; by fomentations, frictions, cuppings, and scarifications.

The third thing required in the cure of an inflammation by resolution, was to add and preserve a fluid state to the obstructing matter, (see § 395.) We therefore now come to treat of the methods and remedies for obtaining these ends, and first concerning those, by which the impervious matter is rendered so fluid, as to pass freely through the narrow extremities of the vessels. But this may be obtained two ways, either by diluting, as when the combined particles of the blood are separated by the interposition of water; or else by attenuating the matter, by the attrition of the vessels, with frictions and such remedies, as by the figure and rigidity of their particles may be capable of dividing the concreted parts. Also diluents and attenuators may be so combined as to produce greater effects by their conjunct powers.

1. Our

1. Our blood naturally tends to concretion by reſt, and this the more as the perſon is ſtronger; a continual motion is therefore neceſſary to alter the ſituation of the particles of the blood, and prevent their concretion; and it is by this ſame motion, that thoſe parts are to be diſſolved, which have once begun to concrete. When a perſon faints away, the blood ſtagnates in the large venous receptacles about the heart, and eſpecially a large quantity is collected in the venous ſinus and right auricle of the heart, and betwixt the lungs, where it begins immediately to be diſpoſed to concretion; but if ſuch a perſon is revived by the aſperſion of cold water, ſoon after a violent palpitation of the heart follows, and the viſcid blood, which began almoſt to form a polypous concretion, will ſtagnate in the ſmall extremities of the pulmonary artery; but upon the contraction of that artery, theſe fleecy concretions will be repelled, and thus will they return backward and forward, till they are at length attenuated and diſſolved by the attrition from the ſides of the veſſel, and thereupon all the anguiſh ceaſes, and the blood has again its free courſe from the right ventricle through the narrow extremities of the pulmonary artery. The ſame effect may be expected, if the inflamed veſſels are reſtored to their elaſtic vibrations, with which they before moved: for if we conſider the cauſes by which our blood is moved in the veſſels, it will appear that its motion muſt be performed even in the inflamed veſſels, which will be firſt diſtended and then contracted again alternately. For when the heart contracts, it expels all the blood contained in its cavities into the arteries, which are already full, and which being flexible will be therefore dilated at the inſtant when the heart is in its contraction, after which the arteries will again contract to their former diameter by the elaſticity and re-action of their muſcular fibres, by which the blood contained in their cavities will be propelled forward; for the valves, placed at the entrance

trance of the aorta, prevent the blood from returning back towards the heart, and therefore it is derived through the arteries into the veins; if now we conceive an obſtacle to be lodged in the cavity of an artery, ſo as to prevent the free courſe of its blood, that artery may be dilated by the impulſe of the blood received from the force of the heart; but that artery cannot contract itſelf again the moment after it has been dilated, becauſe the paſſage of its contained blood into the veins is obſtructed, and the return of it is alſo prevented by the impulſe of the blood urging behind; ſuch an artery will therefore remain full and diſtended, but without motion, becauſe the elaſticity and force of its coats are not ſufficient to remove the reſiſtances. But how can we here reſtore the vibration of ſuch an artery? it may be done barely by diminiſhing the quantity of the diſtending humour; but the obſtructed end of the artery denies a paſſage into the vein, whence there is no other method remaining, but to diminiſh the quantity and force of the vital fluids to ſuch a degree, that the natural contraction of the artery may be ſufficient to prevail, and by that means repel the contained blood towards the baſis of the artery. In that caſe the obſtructing matter, being no longer preſſed by the fluids urging behind, will paſs by the contraction of the artery towards the baſis of that veſſel, unleſs it was ſo impacted in the narrow extremities, as to be quite immoveable, and again the moment after, it will be propelled to its former ſituation in the narrow extremities, from whence an attenuation and diviſion of the concreted particles may be reaſonably expected. But that the concreted blood may thus diſſolve into leſſer particles, ſo as to be capable of paſſing through the narrow extremities of the arteries, has been demonſtrated to the eye, in the experiment of Leeuwenhoeck, which we mentioned in the commentary on § 232. numb. 1. But in what manner the quantity and impetus of the diſtending fluids may be diminiſhed

ed by bleeding and purging, has been declared before at numb. 2 and 3, under the preceding aphorism. But how much may be done towards a reſtitution of the oſcillatory motion of the veſſels, too much diſtended with fluids, is evident in plethoric patients, in whom the pulſe of the artery is often ſcarce perceptible, when the plethora has acquired its utmoſt extent: but when the too great quantity of fluids is diminiſhed by a plentiful bleeding, the pulſe ſoon after riſes, and all the functions are reſtored which were before oppreſſed.

By a ſtimulus added to the fibres by means of a thin aromatic liquor drank very warm.] The celebrated Baglivi, in a treatiſe which he has wrote, *De fibra motrice & morboſa*, has demonſtrated, that there is a propenſity to irritation in the ſolid parts of our body, by which their motions may be ſurprizingly diſturbed by the irritation of ſtimuli, whether by increaſing their natural motion, which they uſed to perform according to the laws of health, or elſe by diſturbing it. It appears from the moſt certain experiments that ſtimuli produce this effect in the larger parts of the body. The ingeſted aliments are conveyed by degrees through the ſtomach, and all the convolutions of the inteſtines, till they arrive at the end of the inteſtinum rectum, and being in this long courſe drained of their more ſoluble parts, are at length diſcharged out of the body: but if the inteſtines are irritated by a ſtimulating purge, the ingeſted aliments will then be hurried through the bowels in a ſhort ſpace of time, with a conſiderable diſturbance from an increaſe of the periſtaltic motion. When acrid poiſons corrode the internal ſurface of the inteſtines, they often cauſe them to contract ſo violently, as to be quite ſhut up in all thoſe places where the poiſon touches, whence the elaſtic air being intercepted, enormous tumours of the abdomen have then been obſerved to follow. Even this irritability is ſo ſtrongly inherent in many parts of the body, that they retain it after death, and exert a mo-

a motion thereby when all the other parts are dead. The obſervation of Lord Bacon, mentioned in the commentary to § 1. informs us, that the heart of a man, who was exenterated, being thrown into the fire, leaped up to a conſiderable height, and continued its motion for the ſpace of ſeven or eight minutes. When Peyerus opened the thorax and abdomen of a cat, when ſhe was ſtiff and dead of an abortion, upon blowing into the receptacle of the chyle, he was ſurprized that the air paſſing to the heart occaſioned firſt its auricles, and then the whole heart to vibrate for ſeveral hours. When the ſame anatomiſt happened to try the like experiment in human bodies, he found it had the ſame ſucceſs, yet ſo that the motion of the heart was more eaſily recalled in ſome than in others: and ſometimes he not only inflated air, which ought to be warm, but he alſo found it neceſſary to uſe an external warmth. He found by experiments that the hearts of thoſe who had been hanged eaſily recovered their motion, and retained it for a more conſiderable time [a]. From all which it is apparent, that the application even of a ſlight ſtimulus to the fibres, viſcera, and veſſels, may excite them to greater motions. When the moſt healthy perſon has taken too large a quantity of ſalt, ſpices, or wine, the heart and arteries will be irritated by thoſe ſtimuli to more frequent contractions, and produce a fever. When therefore the obſtructed veſſels have been a long time conſiderably diſtended by the impulſe of the vital humours urging behind, their fibres are often ſo much diſtracted, that they loſe their force, and do not ſufficiently re-act upon their contained fluid. So ſoon therefore as the quantity and impetus of the diſtending blood has been diminiſhed by bleeding and purging, it will be proper to exhibit ſuch remedies, as by mixing with the blood, and paſſing through the arteries, may irritate their fibres with a gentle ſtimulus, ſo as to contract with a great-

[a] Peyer. Paterg. Anatom. pag. 199.

er

er force, and by that means break or divide the obſtructing particles ſmall enough to paſs eaſily through the extremities of the veſſels, whence the inflammation will be cured by a reſolution. But to anſwer this intention may ſerve, the milder ſort of ſpices drank by the way of infuſion in a large quantity of water, ſuch as the ligna ſantalorum, ſaſſafras, the five opening roots, &c. either infuſed or gently boiled, which can never be prejudicial in ſuch a caſe. Such a form of medicine may be ſeen in the materia medica correſponding to this aphoriſm.

But while theſe remedies are taken plentifully, it will be proper to determine their action towards the affected parts, by fomenting, friction, cupping, and ſcarification; concerning the uſe of all which we treated in the commentary on § 134. But frictions are uſeful in this caſe, as they perfectly imitate and ſupply the action of the veſſels by contraction and relaxation upon their contained fluids. But it is very evident that the frictions are here required to be but gentle, and that they ought never to be uſed to inflamed parts, till the pain and tenſion have been leſſened or removed by evacuating and leſſening the impulſe of the blood.

2. By diluting the impacted matter, by drinking thin and watery liquors warm.

After a large quantity of the humours have been evacuated, and the veſſels reſtored to their vibrations, nothing will be more conducive to cure an inflammation by reſolution, than to fill the veſſels with ſuch a liquor as may very eaſily pervade all the ſmaller veſſels. But ſuch a fluid is water; and the moſt ſubtile parts of our humours, which come under our ſenſes, reſemble water almoſt in every reſpect; from whence it is evident, that water may paſs through even the ſmalleſt veſſels of the body. This fluid therefore drank warm is one of the chief remedies in all inflammatory

matory diſeaſes; for being brought by the laws of the circulation to thoſe parts where the obſtructions are formed, it will there inſinuate and dilute, and be intimately mixed with the obſtructing matter by the action of the veſſels; ſo that by interpoſing itſelf betwixt the obſtructing particles, it will ſeparate them from each other, which we call dilution. But what power water has in removing obſtructions by diluting and attenuating, has been declared in the commentary to § 134 and 135. It is to be alſo obſerved, that water ſerves for a vehicle to all the other remedies which are capable of attenuating and diſſolving the inflammatory concretions: and therefore all thin drinks in which water is predominant, are fit for the ſame purpoſe. Such are the whey of milk, milk and water, mild ſmall beer, decoctions of barley, oats *&c.* and the infuſions of coffee and tea.

3. By uſing attenuants, reſolvents, and ſuch things as are oppoſite to the nature of the obſtructing matter, applied as well externally as internally in the form of decoction, bath, fomentation, vapour, cataplaſm, emplaſter, or ointment.

Although water can diſſolve many concretes, ſuch as all ſalts, things ſaponaceous, mucous, and gellatinous; yet there are many things which water alone is not capable of diſſolving. For this reaſon ſuch remedies are mixt with water, as are known to poſſeſs a diſſolving power; and of theſe ſuch are to be choſen as are oppoſite to the nature of the obſtructed matter. But the obſtructing matter in this caſe is the red blood, or a thinner impervious humour joined with it, ſtagnating in their proper veſſels, or wedged into other ſmaller veſſels by an error of place: at the ſame time there is alſo a greater motion and heat, which incline our humours very much to a ſtate of putrefaction.

See

See § 84. numb. 4 and 5. and therefore the attenuators of the inflammatory concrete, ought at the same time to be very averse to putrefaction. We are acquainted with several remedies of this nature, in which there is not only a great power of attenuating and dissolving, but also of restraining putrefaction. Honey is one thing which possesses these qualities in a high degree, and which was therefore very frequently used in all inflammatory disorders; for by an immoderate or too long an use of this juice, the whole mass of blood may be so dissolved, as to be evacuated from the bowels under the form of water; and it also has the power of preserving or confecting all parts of vegetables from any manner of corruption. Even Herodotus [b] tells us, that the Babylonians buried in honey. Sugar, which is at present so much in use, is endowed with the like efficacy: to these add the recent juices of garden fruits, the roots of succory, goat-beard, vipers grass, *&c.* all which may be used with success in the form of a thin decoction. Among the saline attenuants, nitre is preferable to the rest, because they are either alcaline, (See § 135. numb. 2.) and therefore dispose our humours more to putrefaction, or else they so increase the impetus of the arterial blood, by their stimulus, as to be not easily overcome by the action of the vessels. Various forms of pleasant medicines may be made with these ingredients for internal use; and it will be at the same time useful to apply the like medicines externally to the inflamed part, either in the form of a bath, fomentation, vapours, or cataplasm. But the external application of these remedies seems to be not only useful, inasmuch as the water saturated with the medicinal particles insinuates itself through the bibulous veins of the skin, and mixing with the blood, are by the laws of circulation carried throughout every part of the body, or else they may be determined more to the inflamed part, by deriving with attractives or pro-

[b] Lib. I. pag. 80.

pulsives

pulsives (§ 134.) But the like remedies also act, inasmuch as being diluted with water, they insinuate into and through the arteries themselves, and by that means apply their force immediately to the obstructing matter; for that part of the artery which is beyond the obstruction remains empty, and is not urged by the impulse of the blood from the heart; and all the branches of such an artery, which arise beyond the obstruction, will be likewise empty: from whence that force by which very small tubes attract liquors into their cavities, will cause the fluid medicine applied to enter those branches. If therefore the obstructing particles are plied on all sides by attenuation, as well externally as internally, and if the elastic vibrations of the vessels are likewise restored at the same time, it is evident that the obstructing matter will be in a manner dissolved, provided there is but the least prospect of a mild resolution. But the plaisters and ointments which are applied to the inflamed part for this intention, ought not to be too adhesive, nor to have any considerable acrimony, because then they will rather increase the disorder. (See § 376.) Such of these are therefore to be chosen, which only adhere gently to the skin, and confine the thin exhaling vapours, so as to retain the parts affected as it were in a vapourous bath of its own, and by relaxing the bibulous veins to suffer the particles of the applied remedies to enter more easily.

SECT. CCCXCIX.

THE humours are rendered mild or unacrid by watery drinks, a smooth diet, with mild or balsamic medicines, which dilute and obtund, or by such as naturally oppose the particular species of offending acrimony.

It

It was said before in § 386. that a mild or smooth disposition of the humours was necessary, in order to procure a resolution of an inflammation; and therefore it is not barely sufficient to render the obstructing matter fluid, unless the mildness is also preserved, or that particular species of acrimony corrected which attends. Water, and all watery liquors are more especially useful for this purpose: for nothing is milder than pure water, by which the most violent acrimony of any kind may be so diluted as to be no longer offensive. Even the most concentrated oil of vitriol, which in a moment destroys the part to which it is applied after the manner of actual fire, may be so weakened by a large quantity of water, as that it may be safely taken into the stomach. Now whenever there is an acrimony in the blood, the thirst which it occasions directs the patient to drink a large quantity of water, or some other thin liquor, until it is evacuated or washed out of the blood either by urine or sweat. The truth of this is experienced even in the most healthy people, who have eaten too much salted flesh or the like at their dinner. Besides this, the drinking of thin watery liquors also satisfies the rest of the curative indications, of which we treated under the preceding aphorism. The diet which will be most conducive to the same purpose, is to be composed of emollient pot-herbs, and soft pulse, such as barley, oats, wheat, rice, *&c.* with milk. Hippocrates nourished his patients in these acute diseases with nothing but a drink of barley, as is evident from his book, *De victu in morbis acutis.* The best remedies in this case are those composed of emollients, and things which are gently viscid or mucilaginous, such as marsh mallows, common mallows, mullen and the like in decoctions, with emulsions of oily and farinaceous seeds, the expressed oils themselves of those seeds, and every thing which so obtunds and sheaths acrimony, as to prevent it from doing any injury. But as these oils very soon become rancid, especially in hot wea-

ther, or by the heat of the ſtomach, therefore emulſions are often preferable, in which there is the ſame obtunding virtue of the oil, and that without any danger of its degenerating into a rancid acrimony. But if there is an acrid cacochymia before the inflammation aroſe, or if the like acrimony is obſerved in the juices after the inflammation is produced, then it will be convenient to uſe thoſe things which are known to be ſpecifically oppoſite to the apparent acrimony: thus abſorbents are to be uſed in the acid ſpecies of acrimony, and alſo in the alcaline, but in a putrid ſpecies of acrimony acids are proper, *&c.*

SECT. CCCC.

A Repulſion of the matter is procured.
1. By a large evacuation of the arterial and venal blood by phlebotomy.
2. By relaxing the fibres.
3. By artifical frictions.

It was ſaid in § 395, where we enumerated the general curative indications to be obſerved for the cure of an inflammation, by diſperſion or a reſolution, that if the obſtructed matter could not be rendered ſo fluid as to paſs through the narrow extremities of the arteries, that there then remained but one method of cure; namely by repelling the matters from the ſmaller extremities into the larger veſſels, where they might be taken up with the common circulation, and rendered pervious through thoſe veſſels which they ought naturally to paſs. This method may take place in every kind of inflammation, but more eſpecially in that kind which ariſes from the larger particles of the blood miſtaking their courſe. That is, when the orifices of the ſmaller veſſels are ſo dilated as to take in larger particles than can paſs through their ſmall extremities. For inſtance if in ſuch a caſe

caſe a red globule is repelled back out of the ſerous artery into which it entered, it will return into the ſanguiferous artery through whoſe ultimate extremity it may eaſily paſs into the vein, by which the inflammation will be reſolved or terminated. But in order to repel the matter in this manner, it is neceſſary either to remove or very much diminiſh the impulſe of the vital humours, urging upon the back of the obſtruction; and at the ſame time the obſtructed veſſels are to be ſo relaxed, that they may eaſily permit the impacted matter to return back, and laſtly a motion is to be communicated to the impervious particles, which may carry them back towards the larger part of the obſtructed veſſel; but each of theſe are accompliſhed by the means propoſed in the three following numbers.

1. Concerning this you may conſult what has been ſaid in the commentary on § 141. numb. 1.

2. For the obſtructing matter being wedged into a narrower part of the veſſel, if the fibres of that veſſel are rigid, the matter will be held ſo faſt as to be immoveable: It will be therefore proper in ſuch a caſe to relax the fibres, when the impetus of the fluids urging behind, has been firſt diminiſhed, otherwiſe the obſtructed particles will be thruſt further into the relaxed veſſels, which is repugnant to the indication of repelling; for here we are not to attempt a propulſion of the matter through the relaxed veſſels. But in what manner, and by what remedies, the fibres of the human body may be relaxed, has been declared in § 35, 36, and 54.

3. See what has been ſaid concerning the uſe of frictions for this intention, in the commentary on § 141. numb. 2.

SECT. CCCCI.

FROM hence we may be able to understand what that so much desirable resolution is, by which a compleat cure is performed without any crisis (386.) in all inflammatory diseases, whether external or internal.

In whatever part of the body the inflammation is seated, it always retains the same definite, or precise nature; namely an obstruction of the arterial vessels, with a violent impulse of the vital humours urging on the back of the obstructions. What is it therefore to resolve an inflammation? the answer is, that it consists in so attenuating and dividing the obstructing particles, which hesitate in some arteries, or by so relaxing the obstructed vessels, as to give the humours a free passage through them, which were before impervious; or even sometimes by repelling those particles back into the larger vessels. It is evident enough, that this method of curing an inflammation is of all the best and safest, because it restores the parts to their healthy functions, without offering any further damage to them. But it is not always in the power of a physician to cure an inflammation thus by resolution; the means required for performing which, have been mentioned in § 386.

Which makes a compleat cure.] A resolution only can be properly called a compleat cure of an inflammation, which it removes without inducing any other disorder: whereas the other ways of terminating an inflammation cannot be said to make a compleat cure, since they introduce an abscess or a scirrhus, even though they remove the inflammation; for, in this case, there is another disorder introduced, which will require its particular cure, before the parts can be restored to their healthy state. But when an inflammation

mation terminates in a gangrene, or a ſphacelus, it does not then conduce to a cure, but the death of the parts.

Without a criſis.] What is properly meant by a criſis in diſeaſes, and in what manner this word is uſed in various ſenſes among the ancient and modern phyſicians, we ſhall have a better opportunity of explaining hereafter, when we come to treat more profeſſedly on that ſubject in the hiſtory of fevers. It will be ſufficient for us here to obſerve, that an inflammation is ſaid to be cured without a criſis, when the morbific matter, namely the impervious humours heſitating in the arteries, is ſo diſpoſed by the remaining vis vitæ, and the applied remedies, that it is again rendered capable of paſſing through its veſſels agreeable to the laws of health: but when the ſame matter is removed from the narrow extremities of the obſtructed veſſels, and yet has not thoſe conditions, which are required for it to flow through the veſſels with the healthy humours, without injuring the functions, it is then either evacuated from the body, or elſe depoſited upon ſome particular part, and then the inflammation is ſaid to be cured by criſis, and the evacuation and depoſition of the matter is termed critical. For example, when a red globule has entered a ſerous artery by an error of place, and an inflammation thence follows; if, that red globule be either repelled back from the ſerous into the ſanguiferous artery, or elſe diſſolved into the ſix ſerous globules of which it is compoſed, according to Leeuwenhoeck, that inflammation will be cured without a criſis, becauſe the morbific matter is ſo diſpoſed as to paſs freely through all the veſſels, which it ought to pervade in a ſtate of health. But if the extremity of the obſtructed veſſel is thruſt off together with its impervious matter, by a moderate impulſe of mild humours urging behind, the obſtruction will be thus removed; but then the humours will be extravaſated from the diſſolution of the continuity of the veſſel,

and the separated end of the obstructed vessel with its impervious matter, being no longer obedient to the laws of circulation, is therefore to be considered as a foreign body which requires to be discharged: so that the tender solids which are thus separated mixing with the extravasated humours, are by the heat of the body changed into matter, formed by a mild incipient putrefaction, which matter will therefore require to be evacuated, as it can never be reduced to the state of our healthy juices. And in this manner also an inflammation is cured but by means of a crisis; because the morbific matter is first changed by the remaining vis vitæ, and then separated and discharged from the body. From thence you may plainly perceive the difference between the cure of an inflammation, which is made by a resolution, and that which is made by a crisis: and this doctrine will also appear agreeable to the general axiom which Galen [a] delivers concerning the various events of diseases, *viz. Magni siquidem morbi judicantur omnino: quicumque autem parvi, solvuntur solum*; "That great dis-"eases are always attended with a crisis, but those "which are slight are only resolved." For a slight inflammation may be dispersed, when a violent one terminates either in a suppuration or a gangrene.

Of Abscesses.

SECT. CCCCII.

IF these means (395 to 401.) are used too late, not at all, or without success, the inflammation then goes on to suppuration (387.) which may be known by the signs there (387.) mentioned, and the indications will be

[a] De Crisibus Lib. III. cap. 4. Charter. Tom. VIII. pag. 433.

1. To

1. To haſten the maturation of the crude matters into one ſmooth humour.
2. To mollify the ſame and the parts adjacent.
3. To draw the matter outwards.
4. To procure a diſcharge to the concocted matter.
5. To mundify or clean the parts.
6. To compleat the cure, as in other wounds.

An abſceſs, termed alſo *apoſtaſis* and *apoſtema*, was uſed in various ſenſes by the ancient phyſicians. For Hippocrates [a] uſes this term to denote the change of one diſeaſe into another, when he ſays, *Ex aliis febribus & morbis abſceſſus in quartanas fiebant*: "Some fevers "and diſeaſes become quartans by abſceſs." He alſo uſed the term abſceſs to ſignify that endeavour of nature by which ſhe ſeparated any offenſive matter from the blood, either evacuating it from the body, or elſe depoſiting the ſame upon ſome particular part: and hence the ancient phyſicians diſtinguiſhed two kinds of abſceſſes; namely thoſe by efflux, and ſuch as were made by depoſition upon ſome part [b]. Thus, for inſtance, in a peripneumony, the morbific matter was obſerved by them to diſcharge itſelf by ſpitting, a bilious diarrhœa, or a copious and thick ſediment in the urine; in which caſes the abſceſs was ſaid to be by efflux: but when no ſuch excretion was obſerved, and there were nevertheleſs apparent ſigns that the patient would ſurvive, then Hippocrates [c] obſerves, that an abſceſs is to be expected either about the ears, or towards the lower parts of the body, by a depoſition of the morbific matter in ſome place. And in this ſenſe abſceſſes are defined by Galen [d], *Af-*

[a] Epidem. 1. Textu 21. Charter. Tom. IX. pag. 44.
[b] Galen. Comment. 2. in Lib. I. Epidem. Hipp. Text. 44. Charter. Tom. IX. pag. 55.
[c] Prognoſtic. Charter. Tom. VIII. pag. 655. & in Coac. n. 395.
[d] Method. Med. ad Glaucon. Lib. II. cap. IX. Charter. Tom. X. pag. 382.

fectiones illas, in quibus ab invicem fecedunt, quæ prius se mutuo tangebant, corpora. Spatium igitur in medio vacuum fieri neceſſe eſt, quod materiam aliquam flatulentam aut humidam, aut ex utraque miſtam, continebit. Mutantur autem in abſceſſum & inflammationes quædam, & Eryſipelatoſi Phlegmonodeſque tumores non pauci, &c. "To be thoſe diſorders in which the parts of the "body before cohering, recede from each other. "There muſt be therefore of neceſſity a void ſpace "made betwixt the parts, which ſpace will contain "either a moiſture, or flatus, or a compoſition of "them both. But many tumours of the phlegmo-"node and eryſipelatous kind, and ſome inflamma-"tions are changed into an abſceſs," *&c.* For when the obſtructed ends of the inflamed veſſels are ſeparated by the impulſe of the humours acting behind, they mix with the extravaſated juices, and by the warmth of the parts change into matter, which by removing the contiguous parts, makes itſelf a paſſage: but as a true phlegmon is almoſt conſtantly ſeated in the panniculus adipoſus only, that membrane by its eaſy yielding, may be ſometimes diſtended to a very great degree by the matter which it contains. But that ſuch a preternatural cavity is formed by the confined matter, after the phlegmon is ſuppurated, and that it did not before exiſt, is evident, inaſmuch as by inciſing the inflamed part with a lancet before any matter is formed, the whole tumour appears ſolid, and diſcharges only blood or a thin ichor: but when ſuch a part is wounded after a ſuppuration is formed, and the matter diſcharged, there appears a manifeſt cavity, made by the receding of the parts which were before contiguous.

There is no room to doubt, that the method of curing an inflammation by reſolution is of all the beſt; but as this is frequently not in the power of the phyſician or ſurgeon, then a ſuppuration only remains, ſince it is evident enough, that the other methods of terminating an inflammation; namely, in a gangrene or

or schirrhus, are much worse. If therefore it shall appear from the signs mentioned in § 387. that the inflammation is of such a nature, that a resolution cannot be expected, or if there were some hopes at the beginning, but by a neglect or a perverse treatment continued for many days, the obstructions are confirmed in such a manner, that the matter is quite irresolvable, then the curative indications direct speedily to promote a suppuration, to remove all those parts of the solids and fluids, which have been so changed, as to be no longer obedient to the laws of the circulation; and when this is performed, the lost substance may be regenerated, and the parts united which were separated from their natural cohesion. But this is what we are to consider in the following numbers of this section.

1. So long as the material cause of a disease continues of such a nature, as to either continue or increase the distemper, it is termed crude; but when it has been so altered by the remaining vis vitæ, its own natural disposition, or the use of proper remedies, so as to be less remote from the laws of health, and to produce less disturbance in the functions of the body, it is then said to be concocted; and that state of the disease, in which its material cause is thus altered, so as to be less offensive, is called the time of maturation or concoction. This crudity may therefore take place both in the solid and fluid parts, and so may likewise its alteration or maturation; but in a phlegmon all the obstructing matter is called crude, which cannot be resolved, and also every vessel which is so obstructed that it cannot be opened. In order to restore health therefore, such obstructed vessels with their impervious contained matter, ought to be separated from the rest of the living and pervious vessels, and by mixing afterwards with the extravasated humours, to be formed into laudable matter. So long therefore as the ends of the impervious vessels remain unseparated, the vis vitæ urging on the back of the obstruc-

obstructions, will increase all the inflammatory symptoms, (See § 381, 382.); but when this separation is once made, as the humours will then have a free passage through the broken ends of the vessels, it is sufficiently evident, that all those symptoms must be very much diminished. Crudity is therefore known by the intensity or increase of all the symptoms; but maturation is discovered by the remission of them. This is very well expressed by Celsus [e], where he treats of abscesses: *Crudum est autem, in quo major quasi venarum motus est, & gravitas, & ardor, & distentio, & dolor, & rubor, & durities; &, si major abscessus est, horror, atque etiam febricula permanet: penitiusque condita suppuratione pro his, quæ alioqui cutis ostendit, punctiones sunt. Ubi ista se remiserunt, jamque is locus prurit, & aut sublividus, aut subalbidus est, matura suppuratio est*; "But the matter is crude when the "arteries have a greater motion accompanied with a "heaviness, burning, distention, pain, redness, and "hardness of the parts; and if the abscess is large, a "shivering and slight fever continue: but when the "suppuration is finished, instead of these there are "pricking pains which otherwise point out the part "of the skin affected; and when those pains grow "more remiss, and the part itches and looks bluish, "or whitish, the suppuration is then mature."

2. The hardness or resistance of inflamed parts arise from the great compactness of the solids and fluids. (See § 382. numb. 4.) and so long as they continue, the disorder may be justly termed crude. But maturation requires a separation of the ends of the obstructed vessels from the other sound parts; and therefore the more those vessels are mollified and in a manner dissolved, the sooner, and with less pain will they be separated. But if a violent phlegmon has invaded a part, we generally observe that all the circumference of the tumour remains hard, even though the middle of the part affected turns soft; and there-

[e] Lib. V. cap. 28. n. 11. p. 327.

fore

fore the adjacent parts of the tumour are to be fomented with emollients, as Celsus observes, when he says, *Si qua circa duriora sunt, ad ea mollienda, vel malva contrita, vel fœni græci linive semen ex passo coctum superdandum est*; "If there are any adjacent "parts harder than the rest, they are to be mollified by "the application of bruised mallows, or the seed of "fœnigræc, or linseed boiled in sack."

3. If matter should be formed by suppuration in the inflamed part, which is seated in the external surface of the body under the skin, the skin is then usually elevated into a tumour, and this more especially if the part is fomented with emollient and relaxing medicines. But if the inflammation is more deeply seated, there will be more danger, lest the matter should make itself sinuses in the adipose membrane, or if it is seated in some of the internal parts, it may corrupt the viscera with a putrid tabes. So soon therefore as it appears from the signs mentioned in § 387. that the inflammation tends to suppuration, then all the endeavours of art are to be used to draw the matter to some external part. Celsus [g], in treating of the cure of a pleurisy, recommends bleeding for a severe pain which is recent, but when that remedy is used too late, or proves fruitless, he says, that then, *Confugiendum est ad cucurbitulas, ante summa cute incisa. Recte etiam sinapi ex aceto super pectus imponitur, donec ulcera pustulasque excitet; & tum medicamentum, quod humorem illuc citet, &c.* "Recourse "is to be had to cupping-glasses before the skin is "incised. It is also right to apply mustard and vine-"gar upon the breast, till it has excited blisters or "sores, and then to use a medicine which may stir "up the humour, and direct it thither, *&c.*" In a peripneumony, when the disorder is increased to the highest, he observes [h]; *Prodesse etiam impositum super pectus salem bene contritum, cum cerato mistum: quia*

[g] Lib. V. cap. 28. n. 11. pag. 328.

[h] Lib. IV. cap. 6. pag. 209, 210.

leviter

leviter cutem erodit, eoque impetum materiæ, qua pulmo vexatur, evocat. Utile etiam aliquod malagma eſt ex his, quæ materiam trahunt: "That it may be alſo ſer-
" viceable to apply ſalt finely ground and mixed
" with cerate to the breaſt, becauſe it gently cor-
" rodes the ſkin, and by that means calls off the vio-
" lence of the matter which injures the lungs. It is
" alſo uſeful to apply a cataplaſm of ſuch things as
" draw matter." If now the matter formed can be conveniently drawn outwards, the event of the inflammation need not be ſo much feared; for patients often die after a ſuppuration from a pleuriſy, while the ulcer full of matter does by its tumor preſſing inward obſtruct the lungs, and produce ſuffocation, or elſe by breaking, depoſits its matter into the cavity of the thorax; whence an empyema, conſumption, and death. But if an abſceſs formed about the ribs, ſhould point outwards, and cauſe a tumour in the external ſkin, a happy cure generally ſucceeds by opening the tumour, and diſcharging the matter. Therefore, for theſe reaſons, the antient phyſicians applied irritating ſubſtances to ſtimulate the external parts, or elſe they fomented the parts with emollient cataplaſms and fomentations, to derive the impetus of the diſeaſe outwards.

4. When the ends of the obſtructed veſſels, together with their impervious blood mix with the adjacent humours, and by the warmth and ſtagnation in a cloſe place form a white fat and uniform liquor, it is then ſaid to be concocted matter; but by what ſigns, one may know that ſuch a matter is preſent, we ſhall explain hereafter at § 405. But when this matter is contained a long time in a cloſe and warm place, it becomes gradually thinner and more acrimonious; and as there are ſmall abſorbing veins which open throughout the whole ſurface of the cavity in which the matter is confined, it will be drank up by thoſe veins, and conveyed into the maſs of blood, whence it will occaſion a purulent cachochymy, whence a hectic fever

fever and consumption follow. Besides this the matter rendered more acrimonious will corrode the whole surface of the part in which it is contained, and being at the same time attenuated, it may very easily make itself new passages in the panniculus adiposus; from whence sinuses and fistulæ of the worst kind often follow, barely for want of procuring a timely discharge to the concocted matter. And from hence again the difference betwixt curing an inflammation by resolution and suppuration is sufficiently apparent. For when the inflammation is resolved, the matter of the disease is so scattered by the remaining vis vitæ, and proper remedies, that it becomes very much like the healthy humours with which it flows, through all the vessels without injury to any of the functions; and therefore no evacuation is required. But when a separation is made of those solids and fluids, which the inflammation has destroyed, they then turn into laudable matter; which yet is a liquor quite foreign to the nature of our humours, and by mixing with them disturbs all the functions, and excites a fever, until it is either evacuated from the body, or else separated from the blood, and translated to, or deposited in some particular part of the body; from whence again it must be evacuated, in order to perform a cure. It is therefore evident, that an evacuation of the concocted matter is necessary, and that in due time, since it always becomes acrimonious by long standing. But what ill consequences may follow when matter is too long confined in an abscess, we are taught by practical observations. A maid of forty years old had a suppuration of the left parotid, so that on the fourteenth day of the disease there was an abscess as large as one's fist. But as no fever attended in the beginning of the disorder, and she every day followed her domestic business, yet as the confined matter was not timely discharged, it produced a fever, attended with the worst symptoms, such as faintings, vomitings, watchings, &c. of which she expired a few days after.

after. The abſceſs was indeed broke ſeveral days before death, but little or no matter was diſcharged [h]. In a child of three months old there aroſe an abſceſs about the right ſhoulder; but as the parents would not allow it to be opened, the tumour naturally ſubſided of its ſelf, but the abſorbed matter being tranſlated to the genital parts, it there produced a fatal gangrene [i]. There are many obſervations of the like nature, which demonſtrate how dangerous it is to leave concocted matter confined for too long a time in a vomica or abſceſs.

5. So long as the part ſuppurated remains cloſe, it is termed vomica clauſa or an abſceſs, but when a diſcharge of the matter has been procured either by art or nature, the diſorder is then termed a vomica aperta or an ulcer. But the whole internal ſurface of the cavity, in which the matter was contained, is more or leſs infected by the matter, eſpecially when that has been confined a long time, and rendered more acrimonious by heat. It is not therefore poſſible either to procure a conſolidation or union of the parts, nor a reſtitution of the loſt ſubſtance, before the whole ſurface of the cavity is firſt reduced to the ſtate of a clean wound. Therefore the half dead extremities of the veſſels, and half corrupted parts of the panniculus adipoſus muſt be firſt ſeparated, and all the reſt performed in the manner we directed in the hiſtory of wounds, § 206 to 209. Hence Hippocrates tells us, *Ulcera non purgata coire nolunt, etiamſi adducantur; neque etiam ſponte coaleſcunt. Ulcera etiam, quorum circumpoſitæ partes inflammantur, coire non poſſunt, quamdiu non ceſſaverit inflammatio. Neque, ſi ambientes ulcus partes denigratæ fuerint, aut ſanguis putreſcens, aut varix ſanguinis influxum ſuppeditans adfuerit, talia coire poſſunt, niſi circumſtantes ulceris partes ſanas*

[h] Hildan. Obſerv. Chirurg. Centur. I. Obſerv. 30. pag. 39.
[i] Ibid. Obſerv. 81. pag. 59.

effeceris:

effeceris: "that foul ulcers will not unite, even "though they are retained together; nor will they "conjoin of their own accord. Ulcers likewise, whose "circumjacent parts are inflamed, cannot unite, as "long as the inflammation continues. Nor can such "ulcers be healed or conjoined, if the circumjacent "parts are black, beset with putrid blood or accom-"panied with a varix, which bleeds, all which will "prevent the union, unless you reduce the circum-"jacent parts of the ulcer to their healthy state [k]."

6. After the ulcer has been depurated, it acquires the nature of a clean wound; and then a regeneration of the lost substance, and an union of the parts separated, may be procured.

SECT. CCCCIII.

THE maturation is performed by applying such things as,

Increase the motion of the humours in the part, by fomenting, stimulating, and warming materials, which either warm actually or virtually; and the use of the like remedies in the whole body, may be serviceable by exciting a fever.

The maturation of all crude inflammatory matter into concocted pus, must be performed by the remaining vis vitæ; for when the strength of life is defective or languid, no matter is formed: and therefore *Hippocrates* [l], reckons the appearance of dryness in an ulcer, either before or in a disease, among the signs of death. It is also from a weakness of the vital powers, that the spitting is diminished, or even frequently quite ceases in the latter end of a pulmo-

[k] Hippocrat. de Ulcer. cap. 4. Charter. Tom. XII. pag. 132.
[l] In Prognosticis Sentent. 22. Charter. Tom. VIII. pag. 605.

nary

nary consumption. But the vis vitæ is estimated or measured by the force of the circulating humours through the vessels; and as the obstructed ends of the vessels with their impervious contained matter are to be separated by the impulse of the humours acting behind, it is evident that this separation will be sooner performed, if the strength and swiftness of the blood's motion is increased through the vessels of the part to be suppurated; for then the circulating fluid will strike more frequently and strongly in a given time against the obstructed ends of the vessels, and separate them sooner from their cohesion. Hence it is that we enumerated an increased motion of the humours, among those conditions (§ 387.) which cause an inflammation to tend to suppuration. But it is to be observed, that too great a velocity of the humours suddenly excites a rupture in the vessels, and does not procure a gradual separation of their ends; whence a gangrene follows instead of a mild suppuration, as was observed before at § 388. A just medium is therefore here required, so as to keep up the motion of the humours greater than in health; but not to let them move too violently. But the heat of the inflamed part, when it is seated in the surface of the body, or a more or less fever when it is seated internally, will demonstrate whether the motion of the humours ought to be increased or diminished. Therefore the motion of the humours, if defective, is to be excited by the application of topical remedies to the affected part, and by the use of internal medicines. And as we observed in the comment to § 371. that an inflammation is accompanied with a fever either in the whole or in the particular part of the body, so it will be also necessary to increase the motion of the blood, either in the inflamed part only, when that can be done; or else throughout the whole body, by exciting a slight fever. Thus we see in consumptive patients that there is a slight fever always invades the patient every day, while the matter is forming; but

which fever diminiſhes when the formed matter is ſpit up. Therefore Hippocrates has pronounced in the place we before cited, in the comment on § 387. *circa puris generationes dolores & febres magis accidere quam pure facto:* "that the pains and fever are more intenſe, about the time when matter is forming, "than after it is compleatly formed." In the materia medica correſponding to this ſection, the aromatic gums are recommended to us, ſuch as ammoniacum, galbanum, opopanax, *&c.* in all which there is a moderate ſtimulus, and at the ſame time a ſufficient degree of tenacity, by which they adhere to the part where they are applied, and thus by confining the very ſubtle exhaling vapours, they keep the part as it were in a vaprous bath of it's own, and at the ſame time their aromatic ſtimulus inſinuates into the relaxed veſſels; and hence it is that the application of theſe remedies, has often ſuch happy effects, when a ſcirrhus is feared from too weak a motion of the humours. But all theſe things which excite a greater motion in the affected part, by ſuch a mild ſtimulus, have alſo the virtue of warming or heating; becauſe a greater heat ariſes from an increaſed motion of the humours through their veſſels, as was demonſtrated in the commentary on § 382. numb. 6. Thoſe things are alſo very ſerviceable, which are actually warm, provided they are not applied ſo hot, as to diſſipate the more fluid parts of the humours, and convert the remaining parts into the hardneſs of a ſcirrhus. Therefore the beſt of all, in this caſe, will be to apply warmth with moiſture, namely, to foment the part to be ſuppurated by the uſe of cataplaſms and fomentations, ſecured with hot woollen cloths or the like, to retain the parts in a gentle and conſtant heat. For as Hippocrates [m] ſays, *calidum ſuppuratorium, non in omni ulcere, maximum ſecuritatis ſignum: cutem emollit, extenuat, dolorem ſedat, &c.* "a ſuppurating heat is not a ſign of the greateſt ſucceſs in every

[m] Hippoc. Aphor. 22. Sect. V. Charter. Tom. IX. pag. 207.

" ulcer, though it mollifies and extenuates the ſkin, " abates the pain, &c." but why Hippocrates ſays, not in every wound or ulcer, is explained by Galen, in his commentaries to this aphoriſm; namely, becauſe hot things are hurtful to putrid and running ulcers, by increaſing their putrefaction, and attracting their flux of humours.

2. The heat and motion excited in the part, are there confined by preventing too great an exhalation, and diſſipation of it, by conſtipating or glutinous ſubſtances, and by diminiſhing the too great acrimony.

The inflamed part is always hotter than is uſual in health (ſee § 382. numb. 6.) and as all the ſymptoms of the inflammation increaſe, when it tends to ſuppuration (ſee § 387.) therefore the heat will be increaſed while the heat is forming. But by an increaſe of heat, the more fluid parts of our humours are diſſipated, as will be evident from the commentaries on § 689; therefore it will be extremely ſerviceable to apply ſuch things as continually moiſten as well as warm the affected part, to reſtore thoſe thin vapours which are continually diſſipated by the increaſed heat. Thoſe remedies will be therefore beſt which contain a large quantity of water, and which do not eaſily ſuffer it to exhale again, and ſuch are all glutinous ſubſtances, which with water are capable of forming a ſoft paſte, ſuch as all meals, and eſpecially that of linſeed, which is capable of imbibing a large quantity of water. Of theſe and ſuch like ſubſtances may be formed cataplaſms, which are very emollient, of which there are various forms given in the materia medica, correſponding to this aphoriſm. If theſe are involved on all ſides about the part to be ſuppurated, and ſuffered to continue there day and night, eſpecially if care be taken to keep them warm; it is uſual for any irreſolvable inflammation to ſuppurate and be converted into

into laudable matter; but as all these remedies mollify as well as moisten and relax the solid parts, they very much diminish the pain, attending a suppuration often in no small degree (see § 228. numb. 1.) and they mitigate all acrimony, by sheathing and obtunding; therefore they are likewise serviceable inasmuch as they conduce to that mild disposition of the humours, which is required towards a suppuration, as was said in the commentary on § 317. but as there is here no small danger of a putrefaction in the humours which stagnate in the obstructed vessels (see § 84. numb. 4, and 5.) promoted by the increased heat and quicker motion of the humours, through those adjacent vessels which remain pervious, therefore such substances are to be chose, which are soon altered into a disposition opposite to that of putrefaction, by the heat of the part by which they are applied; that is to say, which easily turn sour. Hence it is, that surgeons add rye flour, vinegar, sorrel, and the like substances, which soon turn acid, in the composition of their maturating cataplasms: and to these, they usually add also fresh butter, linseed oil, or the like, very soft fat substances, partly because they prevent too great a dissipation of the moisture, from the cutaneous pores; and partly, because, by this means, the cataplasm is prevented from drying and growing hard too soon.

3. By moderating the motion of all the vital humours, and their temperature, so that they may neither be sluggish nor excited too much.

This rule is of the greatest moment in the practice of physic, as well in the cure of internal as of external diseases. An increased motion of the humours, causes an inflammation to tend to suppuration (see § 387.) but too violent a motion of them, causes a sudden destruction of the very tender and minute vessels, and produces a gangrene (see § 388). But in the resolution of an inflammation the motion of the humours is

but moderate, (see § 386.) So long therefore as there is hopes of a resolution, the physician or surgeon boldly diminishes the impetus of the vital humours, by the remedies mentioned at § 396. in order to prevent any further injury from being offered to the inflamed vessels: but when the signs denote that it is impossible to resolve the inflammation, then it is required to give the humours a greater motion than they had naturally in a state of health, in order to separate the obstructed ends of the vessels, and convert them with the extravasated humours into laudable matter; from whence it is evident, that in such a case it may be often prejudicial to use those things which weaken the force of the circulation. It is therefore here necessary so to moderate the course of the humours through the vessels, as to make them pass with a greater heat and motion than is usual in health, either by the exhibition of medicines internally, or by the application of topical remedies to the affected part, where the suppuration is to be made; but yet these remedies ought not to be so violent, as to destroy all the vital influx of the humours, by suddenly bursting the vessels, that is, so as to produce a gangrene. That the humours flow thus moderately, may be known, if the heat of the inflamed part does not much exceed the heat of the blood in health; if a pain attends, but not violent; if a moderate pulsation is perceived, together with a tumour, redness, and the other symptoms of inflammation gradually increasing: and by the appearance of these signs in the affected part, we are informed whether the vital motion of the humours ought to be increased or diminished. But when the inflammation is so great as to disturb the whole body, then the intensity of the fever, thirst and dryness of the tongue, easily demonstrate what ought to be done to moderate their violence. There is therefore no universal suppurating medicine; but different remedies are required, according as the motion of the humours is to be either increased

creaſed or diminiſhed. To promote a ſuppuration in the body of a young perſon of a warm habit, it will be proper to apply a cataplaſm of oatmeal, milk and freſh butter; but in old people of a melancholic or cold habit, it will be proper to add roaſted onions, galbanum, gum ammoniacum and the like moderate ſtimulators, that by gently increaſing the motion of the humours a ſuppuration may the better ſucceed in the inflamed part, and prevent a ſcirrhus; which laſt is too often the conſequence of an inflammation, that is too languid in ſome glandular part. The ſame doctrine is alſo true in regard to internal inflammations. Thus, in the beginning of a pleuriſy, a very bold uſe of the lancet continued till the patient faints, often removes the diſeaſe; but when the phyſician, being called too late, perceives that it is no longer poſſible to procure a reſolution, it then remains to concoct or digeſt the morbific matter, and diſcharge it either by ſpitting, urine, or ſome other evacuation; or elſe, finally, to convert it into an abſceſs. And at that time bleeding, and other evacuations which too much weaken the vital powers, are always prejudicial; ſince, in ſuch a caſe, a moderate fever is required to maturate the crude matter of the inflammation.

4. The inflamed part is not to be opened till all is ſuppurated, which remains irreſolvable. For by theſe means laudable matter is made in the part.

It frequently happens in the larger abſceſſes, that the center of the ſuppurating part appears ſoft and yielding to the fingers, while in the mean time, the greater part of the tumour which is inflamed, continues hard in all its circumference. But as many bad conſequences may follow, by confining the matter too long in a cloſe place, after it has been formed, as we ſhall explain more at large in the commentary

on § 406. therefore surgeons usually make haste to open such tumours, even when they perceive but a small fluctuation. But all the disorders which have been observed to follow too long a confinement of the matter, proceed either from the acrimony or putrefaction, which it, by that means, acquires; and as the quantity of it gradually increases, it eats new passages into the panniculus adiposus, and produces sinuosities and fistulous ulcers; or else a purulent cacochymy is produced in the blood from an attenuation and absorption of the matter taken up by the bibulous veins; or lastly, the more fluid parts of the matter being dissipated, the rest thickens and produces scirrhous tumours, especially in the glandular parts. But so long as the part remains not opened, and no access is given to the air, the matter does not so soon degenerate into a putrid state; but being confined within its cavity by the hard circumference of the tumour on all sides, it cannot easily burrow into the panniculus adiposus: nor can there be any great danger of the matter's being absorbed, since the arterial vessels which are distended with an irresolvable inflammatory matter, compress the adjacent veins. Besides this, the matter lodged in an abscess, which is but thus half maturated, makes one of the best remedies, by which all the adjacent, or as yet hard and crude matter may be dissolved or consumed. [a] Hippocrates has a sentence of the like nature, which we mentioned in the comment on § 323. *Necesse est, carnes contusas & laceratas in pus versas tabescere:* "Contused and "lacerated flesh, must necessarily be dissolved and "changed into matter." Thus it was also observed in the commentary on § 158. numb 7. that the matter formed in a wound, dissolved the lacerated fibres and extremities of the inflamed vessels, with their obstructing matter. It is therefore evident, how useful it must be not to open the suppurating part, till all

[a] De Vulner. Capit. cap. 14. Charter. Tom. XII. pag. 121.

the

the crude inflammatory matter is brought to maturation: for thus we imitate nature, who most happily accomplishes the suppuration of what ought to be changed into matter, while the integuments of the part remain whole. In like manner, after the parts have been divided by a recent wound, and the hæmorrhage is over, a bloody crust is then formed upon the surface of the wound, which is cleansed by a mild suppuration under that crust. And hence Hippocrates [b] every where observing the dictates of nature, lays it down as a medical axiom, *Quæcumque concoqui oportet, occludi convenit; contraria vero exsiccare & aperire:* "That whatever is required to be concocted, "ought to be shut up from the air: but when the in-"tention is contrary, we are to open and dry up the "parts."

If now every thing is put in practice, which we have enumerated in the four preceding numbers, then laudable matter will be formed in the part: but what the conditions of good and laudable matter are, has been said in the commentaries on § 387.

SECT. CCCCIV.

UNless the inflammatory matter is thus altered or maturated, it will be both dangerous and unsuccessful to make an opening of the abscess.

For if the tumour is opened before the matter of an inflammation is brought to maturity, mere blood is then discharged instead of matter, as we said in the commentary on § 382. numb. 2. or, if the matter is but in part suppurated, by discharging that, the rest will be indurated, and cannot so soon and so easily be brought to maturation. Besides this, when tumours are laid open by incision in their crude state, they always excite more severe pain, and there is greater

[b] Epidem. Lib. VI. Textu 34. Charter. Tom. IX. pag. 416.

danger of injuring the subjacent parts, by perforating the skin. For in a mature abscess, the confined matter elevates the skin from the subjacent parts; and therefore an opening may be more easily made by the lancet, when its sharp point enters into a cavity full of matter; whence there will be no danger of injuring the vessels, or muscular fibres. Hence Celsus [a], in treating of abscesses, which are formed in nervous parts, says, *Sed cætera etiam subcruda aperiri possunt; inter nervos ultima exspectanda maturitas est, quæ cutem extenuet, eique pus jungat, quo propius reperiatur:* "But though in other tumours which are in some "measure crude, an opening may be made; yet a-"mong the nerves or tendons, the last degree of ma-"turity is to be waited for, whereby the skin may be "extenuated, and come into contact with the matter, "as it points more outward." The same will be also true in those places, in which there are large blood-vessels seated, as in the groins and armpits, in which there are inflammatory tumours frequently formed, tending afterwards to suppuration. For no prudent person will open such an abscess before the maturation is compleated, because the large vessels, or their considerable branches may be easily injured, to the hazard of the patient's life, when they are opened too soon. But how much the cure will be retarded, and the pains augmented, if an abscess is opened while crude, is evident from the observations of the best surgeons. For a very painful and inflammatory tumour was formed after a fever in the axilla of a certain nobleman; the surgeon who attended, was urged by more prudent advice to open the tumour with a lancet, as soon as he perceived a slight fluctuation, which was performed with no small pain to the patient, who was not at all relieved by the small discharge of matter, but on the contrary, the fever and inflammation were increased. The disorder was afterwards cured by a long continued use of emollient ca-

[a] A. Corn. Cels. Medic. Lib. VII. c. 2. pag. 409.

taplasms,

taplasms, though it might have been cured in a few days time, if the tumour had not been injudiciously opened before its maturation was compleated. The same thing is also proved by many more instances, alledged by the celebrated le Motte [b], whom we have so frequently quoted. Thus I have sometimes seen venereal buboes, which being opened too soon for fear of a confirmed lues, have occasioned the greatest difficulties, and often proved incurable for several months; the surgeons being obliged to consume them by caustics, when the same thing might have been prevented with certainty in a few days time, by letting the matter continue longer confined in the parts. But it is to be observed, that the outward margin in abscesses has often some degree of hardness, while the rest is perfectly brought to maturity: now when such tumours break of their own accord, and discharge all their matter, those hard remains are usually melted down and discharged in a few days time. It will not be therefore prejudicial to open such tumours, as have the greatest part of them suppurated.

SECT. CCCCV.

THAT the matter is formed and fit to be discharged, is known by the softness of the part, a fluctuation and whiteness of the pressed tumour, a remission of the pain, heat, redness, tension, pulsation, and fever, instead of which a dull or heavy pain succeeds, and the tumour forms a prominent point.

Since therefore it is dangerous to open a tumour, which tends to suppuration, before it is perfectly maturated; and as many bad consequences may also follow, if the formed matter is too long confined and

[b] Traité complet de Chirurgie, Tom. I. pag. 211, &c.

shut

ſhut up, as we ſhall declare under the following aphoriſm; therefore it is neceſſary to give a diligent attention to thoſe ſigns which inform us, that the matter is ſo far advanced and collected in an abſceſs, that it may be ſucceſsfully diſcharged by opening. But theſe ſigns are deduced from the alteration of thoſe appearances which happen in the affected part, while the irreſolvable matter is ſuppurated, even until a perfect maturation is compleated.

A ſoftneſs of the part.] It was demonſtrated in the commentary on § 382. numb. 4, that a conſiderable hardneſs in a phlegmon proceeded from the ſolids and fluids being violently compacted together, becauſe the inſpiſſated blood ſtagnated in the obſtructed veſſels, which were as yet intire. But when the diſtended veſſels are burſt open, and their humours extravaſated in the ſuppuration of a phlegmon, the tender ſolids are then torn off, ground together, and diſſolved in the humours, ſo as to form matter, (ſee § 387.) whereupon a ſoftneſs conſequently follows, by a converſion of the inflammatory matter which was before hard and crude, into a yielding fluid under the entire ſkin. For there may be a conſiderable hardneſs in bodies, which are even compoſed for the moſt part of fluids, provided the juices are contained in diſtinct veſſels, and not accumulated together into one part; of which we have an inſtance in apples, pears, turnips, &c. for though theſe fruits have an incredible quantity of juice, yet they often appear very hard; but by bruiſing, or by dreſſing with fire, they turn into a ſoft pulp; becauſe then the elaſtic air concealed in thoſe fruits, being rarified by heat, breaks their veſſels, and extravaſates their humours, inſomuch that the hardeſt apple is thus ſoftened to ſuch a degree in a quarter of an hour's time, that it runs or ſpreads about. The ſame thing alſo happens, when the continuity of the veſſels in ſuch fruits is diſſolved by putrefaction.

Fluctuation

Fluctuation of the preſſed tumour.] That ſurgeons may be aſſured whether or no the inflamed part is uniformly ſuppurated, they uſually apply their fingers to each ſide of the tumour, preſſing it gently firſt to one ſide, and then to the other: and if then they perceive a fluctuation or undulating motion of the contained humour upon the ſide oppoſite to that which they preſs'd, they then know that the whole compaſs of the tumour is ſufficiently maturated. But when no ſuch fluctuation can be perceived, even tho' the tumour appears ſoft on all ſides; then there may be ſome crude inflammatory matter in its middle, which may hinder the motion impreſſed on one ſide of the humour, from being communicated to the oppoſite ſide. But that there are ſuch abſceſſes which are in a manner divided in the middle by a crude matter there ſeated, while there is a perfect maturation in their circumference, we are taught by chirurgical obſervation; and even Hippocrates [a] has obſerved the ſame, when he ſays, *Tubercula foras protuberantia, in acumen ſublata & faſtigiata, & æquabiliter commatureſcentia, neque in ambitu dura, & deorſum tendentia, neque bifida, meliora (ſunt.) Contrari mala, & quæ plurimum contraria, peſſima:* "Tumours which project outwards, and form a point after the pain is "abated, and which are not hard in their circumfe- "rence, but uniformly maturated and tending down- "wards without a diviſion in their middle, theſe are "of the better kind: but the contrary ſort are bad, "and thoſe which are the moſt contrary are the "worſt." Alſo Galen [b], in his commentaries on this text, obſerves, *In bifidis medium non ſine vitio inveniri, crudum (ἀνεκπύητον) nempe & durum:* "That "in tumours which are thus divided, the middle is "obſerved to have one fault, namely, a part that is "crude and hard." It is indeed true, that a mature

[a] Epidem. Lib. VI. Textu 13. Charter. Tom. IX. pag. 375.
[b] Ibid. pag. 376.

abſceſs

abſceſs has this fluctuation in common with aneuriſms, and ſome veſicular tumours which contain juices; but yet an abſceſs is very well diſtinguiſhed from theſe, inaſmuch as it follows from an inflammation preceding. But it is ſufficiently evident, that this fluctuation cannot be eaſily perceived by preſſing upon the tumour, unleſs it is protuberant; for when an abſceſs is lodged deeply in the panniculus adipoſus among the muſcles, it cannot be eaſily diſcovered by this ſign.

Whiteneſs.] It was demonſtrated in the commentary on § 382. numb. 1. and 2, that redneſs accompanies an inflammation, becauſe the obſtructed veſſels are diſtended with red blood, together with the panniculus adipoſus; and therefore when the impacted inflammatory matter, together with the ends of the obſtructed veſſels, paſs into white and uniform matter, then the cauſes of the increaſed redneſs will be removed. Beſides this, while the matter is derived outwards, with the application of emollient cataplaſms or fomentations, they extenuate the ſkin; which therefore becomes waſted, and acquires a white colour. For when the exhaling vapours of the ſkin are confined by the application of a plaiſter, they moiſten the ſkin ſo much, that in a few days time, it appears white; and by degrees the ſubjacent white matter appears through the extenuated ſkin, which conduces to render it of that colour. From hence therefore the reaſon is evident, why a white colour is juſtly enumerated among the ſigns of a mature abſceſs. Celſus [c], in treating of abſceſſes, takes notice, *Et, quod de ſubito durius non eſt, melius eſt: & quod, quamvis rubet, coloris tamen in album mutati eſt: quæ ſigna jam pure oriente naſcuntur: tumor enim ruborque multo ante incipiunt:* "That the tumour which does not immediately appear harder than uſual, is of the better "ſort, and ſo is that which having looked red, has "yet altered its colour to a white, which affords the

[c] Lib. V. cap. 28. n°. 11. pag. 326.

"proper

" proper signs of forming matter: for the tumour and " redness begin much earlier."

Remission of the pain, heat, redness, tension, pulsation, and fever.] All these signs of inflammation are produced by the impulse of the blood received from the remaining *vis vitæ*, by which it urges against the ends of the obstructed vessels, with an increased force and velocity (see § 381.); and the reason of all these we gave in the commentaries on § 382. Therefore after the ends of the obstructed arteries have been separated by a suppuration, the cause of these symptoms will be removed, or at least be very much diminished; and therefore Hippocrates justly observes, that the pain and fever are greater about the time of the matter's forming, that when it is already formed, (see the passage cited from him in the commentary on § 387.) But it must be observed, that sometimes the most acute pain continues, even though the part to be suppurated has acquired a perfect maturation, and this because the confined matter daily increasing, gradually distends the superincumbent skin; but this pain immediately ceases, when the abscess either breaks spontaneously, or is opened with a lancet. Therefore Celsus [d], having enumerated the signs by which the crudity of an abscess is discovered, (see the commentary on § 402. numb. 1.) immediately subjoins, *Ubi ista se remiserunt, jamque is locus prurit, & aut sublividus aut subalbidus est, matura suppuratio est:* " When these " signs are diminished, and the part begins to itch, " or appear blueish or whitish, the suppuration is then " mature." For it must be observed, that though the skin generally appears white when the abscess is mature, yet the cutaneous vessels are sometimes so much compressed by the distending matter, that by the destruction of the vital influx and efflux of the humours through them, the skin acquires a livid colour, and becomes gangrenous. Almost the same signs of a maturation of an abscess are related by

[d] Lib. V. cap. 28. n°. 11. pag. 327.

Ægi-

Æginetaᶜ; for he says, after enumerating the signs which denote that the inflammation tends to suppuration, *Consummato abscessu, plurima (horum) minuntur, punctura autem pruriginosæ fiunt, & torpor sentitur, & tumor in apicem acutum elevatur, tangenti lenis & cedens, & superficies circa apicem abraditur* (ὑποσύρεται): "After the abscess is formed, many of these symptoms are diminished, a pricking or an itching follows, a torpidity is felt, and the tumour is elevated into a sharp point, soft and yielding to the touch, and the surface about the point of the tumour is gradually abraded." He well remarks the manner in which the skin is gradually eroded by the confined matter extending to the point of the abscess.

The tumour forms a prominent point.] When a phlegmon tends to suppuration and maturity, there is almost constantly a softness and fluctuation perceived in the middle, even though the circumference remains as yet hard; but as it is usual to apply emollient cataplasms to promote the suppuration, therefore the relaxed integuments usually give way in their center to the matter which is gradually formed, by which they are extended above the equable surface of the tumour; since in the other parts of the tumour, its greater hardness prevents its easy extension. For this reason therefore the tumour will be formed with a point outwards, in which place the integuments being gradually weakened and distended, the abscess will there break of its own accord, or may be most safely opened by the lancet.

A dull or heavy pain.] It was said a little before, that the pain increased as long as the inflammation lasted in the suppurating parts: for the ends of the obstructed vessels are to be gradually broke off, and therefore when the nervous fibres dispersed thro' the coats of the vessels, are the nearest to breaking, the pain will be the most acute, (see § 221.) but will cease when they have been quite broke asunder. But

ᶜ Lib. IV. cap. 18. pag. 64.

then there will be matter formed, from the juices extravasated in some preternatural cavity which they make, or else collected in some natural cavity dilated; and by the weight of the matter distending the parts, there will be a dull or heavy pain, as if caused by a weight. For though a healthy person does not perceive the weight of his own body, yet when the humours are extravasated and collected, he will immediately perceive a heaviness or pain of weariness. When the blood is collected in the panniculus adiposus, after a rupture of the vessels under the entire skin, from some violent contusion, the patient immediately complains of an unusual heaviness, or uneasiness in the part, (see § 320. numb. 2.) When the serum accumulated in the dropsy called *anasarca* distends the legs, the patient draws them after him as if they were made of lead. But it is very evident, that this sense of heaviness can take place only when the suppuration is large; it being one of the principal signs of a latent abscess from an internal disease, if after an acute pain, the patient perceives the sense of an internal weight pressing upon the affected side, as will hereafter be made evident in the pleurisy, perpipneumony, and the like diseases, when we come to treat of them particularly.

SECT. CCCCVI.

IF now the matter be left a long time confined in the part, it becomes attenuated, putrified, augmented, and erodes or consumes the adjacent parts, by which with its quantity, weight, and motion, it creates sinuses and fistulæ of different kinds in different parts of the body, but the worst in or near the intestinum rectum. Or else the more thin juices of the matter being dissipated, the rest is indurated, and forms hard tumours,

more

more eſpecially ſeated in glandular parts; or laſtly, the matter being abſorbed by the lympathic veins, or elſe preſſed into the mouths of the eroded blood-veſſels, it then mixes with the blood, which it infects, and being collected in the viſcera, conſumes them with abſceſſes of the worſt kind, diſturbs their functions, and by that means produces an infinite number of diſeaſes of the very worſt kind.

After it has appeared from the ſigns mentioned under the preceding aphoriſm, that all the crude inflammatory matter is brought to maturity, and changed into a laudable matter, then that matter ought to be diſcharged as ſoon as poſſible: for when once the matter is arrived to its laſt perfection, being white, thick, ſmooth, uniform, and inodorous; from that time it begins gradually to degenerate, and is every day altered for the worſe. For the matter is not contained in the veſſels, nor is it any longer obedient to the laws of the circulation, but ſtagnates, and by the warmth of the parts, naturally inclines to a ſtate of putrefaction. For the parts of animals putrefy, though confined in a cloſe place, cut off from any communication with air, only they corrupt then more ſlowly. We alſo obſerve, that all our humours become thinner by putrefying matter; for though blood immediately congeals after it is taken from a vein, yet at length it entirely diſſolves when it begins to putrefy. The cyſtic bile, which is always thicker in healthy quieſcent animals, does yet become thin and fluid by putrefaction. Therefore when clean and laudable matter is too long confined in an abſceſs, it loſes its unctuoſity, and balſamic thickneſs, by which it almoſt reſembles the cream of milk, and is changed into a thin ichor; but this great tenuity ariſing from putrefaction, is always accompanied with a greater acrimony, as we ſaid in the commentaries on § 86: the whole

whole internal surface therefore of the cavity, in which the attenuated and acrid matter is confined, will be continually macerated and corroded by the sharp ichor, the ends of the small vessels will be dissolved, and their extravasated humours will acquire the same kind of corruption; so that the sides of the containing cavity being continually eroded, the sinus of the abscess will be always increasing, and the quantity of matter will be enlarged, by the humours derived thither from the eroded vessels. There are innumerable and evident observations to be found in the most approved authors, which prove that the solid parts of the body may be consumed or corroded by the matter, which has been too long confined and rendered putrid. The lungs have been so much consumed after an empyema, that there were scarce any remains of that important viscus to be seen, as we read in Schenckius [a]. The same author also has an observation of the compact substance of the heart itself, and its pericardium dissolved or corroded by matter [b]. And most surgeons lament frequently, that the solid bones are corroded and rendered carious by corrupt matter in deep suppurations, *etc.* Hence the reason is evident why Hippocrates [c] pronounced that those empyematic patients might recover, in whom there is a discharge of white and pure matter, after the operation performed either by incision or cauterization; but that if the matter was discharged bloody, filthy, and ill smelling, they must perish. As [d] he also observes in an abscess of the liver, that the patient will perish if a foul matter is discharged when he makes water; for in that case the substance of the viscera being corroded by the matter, renders the case extremely dangerous.

[a] Observat. Medic. Lib. II. pag. 251.
[b] Ibid. p. 274.
[c] Aphor. 44. Sect. 7. Charter. Tom. IX. pag. 315.
[d] Ibid. Aphor. 45. Sect. 7. pag. 316.

Beſides this, as an inflammation is the moſt frequently ſeated in the tunica adipoſa, as we ſaid before at § 374; therefore a ſuppuration ariſing from the inflammation, will be ſeated in the ſame part. But the very tender fabric of this membrane, may be very eaſily corroded by matter which is become acrimonious; even the matter may ſo diſtend this very eaſily dilatable membrane by its weight and bulk, that it may make itſelf new paſſages and ſinuſes of the worſt kind. In the commentary on § 244. and 300. numb. 5. It was demonſtrated, that the air entering the panniculus adipoſus, ſometimes produced a ſurpriſing emphyſema or windy tumour, in which the whole body was in a manner buried; from whence it appears, that there is a ready paſſage from any one part of this membrane into all the reſt of its extent. Thus I have ſeen, for want of diſcharging the matter which was formed by a ſuppuration of the parotide gland, that it has made itſelf a way downward, through the panniculus adipoſus of the neck to the ſhoulder, arm, and even to the bending of the elbow: inſomuch that the ligaments which connect the articulation of the elbow, were ſo corrupted, that it afterwards produced an incurable anchyloſis. An abſceſs was formed after a deep inflammation, round the articulation of the femur; and as the matter concealed under the large muſcles could not be evacuated, it deſcended and formed a ſinuous ulcer, running thro' the whole length of the thigh and leg: whence the robuſt youth was deſtroyed by a purulent cacochymia, after ſuffering the moſt tedious afflictions, and trying all means to no purpoſe. If now we alſo conſider, that the matter collected in the cellular membrane is attenuated by the warmth and ſtagnation, and that it often lies under ſtrong muſcles, it is very evident, that being preſſed by the motion of thoſe muſcles, it may be propelled through all the adjacent parts, and by that means produce ſinuſes and fiſtulæ of the worſt kind, more eſpecially when the matter inſinuates into

into the cellular membrane, which is interposed betwixt the muscles themselves. Now as the tunica adiposa is of a greater thickness, or as there are a greater number of strata of muscles lying over each other above the suppuration, so much the worse sinuses or burrows may be formed by the too long confined matter. And hence it is, that such troublesome fistulæ and sinuses are sometimes observed in the abdomen, by reason of the great quantity of fat there seated and interposed betwixt the several strata of the abdominal muscles, as we observed before in the commentary on § 307.

There is no part of the body in which there are worse fistulæ and sinuses formed by matter being too long confined, than about the intestinum rectum. For as the grossest fœces must pass through that intestine to be discharged, it was necessary that it should be capable of an easy dilatation every way; and therefore there is a large quantity of soft fat placed all round this intestine, into which the confined matter which has been too long retained in an abscess, may penetrate and form sinuses: for as Hippocrates [e] observes, *Putrescens enim mollia depascitur, quum intestinum rectum humidum sit, et caro mollis, in qua pabulatur, donec tuberculum rumpatur, et infra versus intestinum rectum computrescat:* "The matter corrupting "eats away the soft parts, because the intestinum "rectum is moist, and its parts soft, in which the "abscess burrows, until the tumour breaks, and pu- "trefies downwards towards the intestinum rectum." If now the rectum itself is also corroded, the matter may spread itself through the cellular membrane, and mucilaginous cryptæ, *&c.* of that intestine, so as to produce most tedious maladies, which are still much increased by the foulness of the intestinal fœces which are to pass this way. Hippocrates fearing these disorders, would not have a maturation of the tumour to

[e] Hippocrat. de Fistulis, cap. 1. Charter. Tom. XII. pag. 141.

be waited for, but would have it opened as soon as possible, even though crude [f].

Or by dissipation of the more thin juices, *etc.*] This sometimes happens to an abscess, though but seldom, and especially when it has been treated with very hot medicines without the addition of emollient and moistening ingredients. Thus it is customary with the women to expose a suppuration of their breast to the heat of a burning coal, to avoid having the abscess opened by the lancet of the surgeon. In that case the more thin juices being dissipated, the remainder is compacted into a scirrhus, which will be in danger of turning to a cancer as long as the patient lives; which change of it does but too often happen. The like hardness frequently remains after venereal buboes have been opened before their time of a complete maturation, or which have been treated with remedies too hot. The caution of Galen [g] is therefore here seasonable, which he gives in treating on the cure of a phlegmon or an erysipelas, when a scirrhus might be feared from those disorders; for he says: *Quod si quis vehementer trahentibus et discutientibus medicamentis vacuare tentet, nec iis, quæ humectent et calefaciant, molliat ac liquet; huic paucis primis diebus pulchre successisse curatio videbitur; illud vero, quod de affectu restabit, insanabile erit. Si quidem toto, quod in eo erat tenuium partium, discusso, quod reliquum est, velut lapidosa concretio linquetur.* "But if any one attempts to evacuate with medicines "which draw or discuss too violently, without adding "those with moisten as well as warm, and mollify as "well as dissolve, he will imagine the cure goes on "very well for the first few days, but yet that which "is left of the disorder, will prove incurable. For "all that matter being discussed, which consisted of "thin particles, the remainder is left like a stony con-"crete."

[f] Ibid. cap 2. pag. 142.

[g] Galen. Method. Med. Lib. XIV. cap. 4. Charter. Tom. X. pag. 322.

Or

Or laſtly in the ſanguiferous or lymphatic veins, *etc.*] It was ſaid before in the commentary on § 158. numb. 7. that matter was formed in wounds by an extravaſation of the humours from the broken ends of the veſſels, which were inſpiſſated either by a diſſipation or abſorption of their more fluid parts by ſtanding. For if a wound is cleanſed every hour, we ſhall not find any matter but only a thin humour, which would become matter within the ſpace of twelve hours. But the more fluid parts of the extravaſated humours ſeem rather to be abſorbed by the mouths of the veins, than to be diſſipated externally; becauſe laudable matter is not uſually formed, unleſs the wound is well covered by ſome plaiſter or ointment, and we know that there are the mouths of the divided veins, as well as of the ſmall arteties opening throughout the whole ſurface of the wound, which may drink up the contiguous juices by that power with which very ſmall glaſs tubes attract liquors, and by tranſmitting them afterwards to the larger veins, thoſe humours may at laſt mix with the blood. In the ſame manner likewiſe when matter has been too long confined in an abſceſs, it naturally becomes much thinner, and putting off it's mild balſamic nature, it becomes acrimonious, and then being abſorbed by the contiguous orifices of the veins, it infects the blood with a purulent cacochymy, whence a hectic fever and a conſumption follow. But that matter confined in any cavity of the body, may be thus abſorbed by the mouths of the veins, and mixed with the blood, we are taught by many obſervations. A certain nobleman was ſhot through the fore-arm with a bullet in the time of battle, by which the bones of the cubitus were fractured, whence a continual fever and many bad ſymptoms followed, and at the ſame time a large abſceſs invaded the wounded and adjacent parts. When the ſurgeons were about to open the abſceſs which they now thought mature, the patient was ſeized with a profuſe diarrhœa, and immediately all the tumour of the limb ſubſided, a large quantity

of matter being visibly discharged in the patient's stools. And when afterwards there was more matter formed in the abscess, upon a return of the diarrhœa, that matter also disappeared, and in this manner was that dangerous wound cured. [h] Scultetus [i] tell us, that he saw a large quantity of matter voided with the urine, in a man who was wounded in the abdomen, by which all the symptoms were relieved. Galen [k] also observed an abscess of the lungs voided by urine, and one of the thorax discharged by stool. A vomica of the lungs attended with a distortion of the spine, has been observed [l] to be cured by a purulent dysentery continued for several days; and this notwithstanding the weakness and many bad symptoms, persuaded the most expert physicians, that there was no further hopes remaining; and the girl was not only in a manner snatched from the jaws of death by this flux, but also the distortion of the spine amended of itself. In the small-pox how often do we observe, that the absorbed matter excites a fever of the worst kind? and that afterwards the matter being deposited in different parts of the body, suddenly produces tumours, which being opened, discharge a true matter, and sometimes degenerate into ulcers of the worst kind. In short, there are an infinite number of observations given us by authors of the best credit, which demonstrate that matter being too long confined, may be absorbed by the veins and mixed with the blood, so as to be afterwards deposited in several other parts of the body: it is also evident from those observations, that the event of this translation is very doubtful and various, according to the nature of the particular parts, in which the matter is deposited from the blood. For though in the preceding cases, the matter was happily discharged by urine or stool, yet there was always great

[h] Bellostе Chirurg. d'Hopital. part. 3. chap. XV. pag. 264.
[i] Armament. Chirurg. Observ. 61. pag. 245.
[k] De Locis Affectis, Lib. VI. cap. 4. Charter. Tom. VII. pag. 517.
[l] Acad. des Sciences l'an 1731. Mem. pag. 724. &c.

danger

danger of its corrupting some of the viscera, or of depraving the whole mass of blood with which it mixes, so as to produce incurable diseases. For the matter which is collected in an abscess, which is not opened, can scarcely be absorbed, until it is first attenuated, and rendered acrimonious, and when it afterwards flows with the blood through the vessels, it acquires a still greater acrimony, whence fevers of the worst kind, a corruption of the blood itself, and an infinite number of diseases follow. From hence we often observe in the small-pox, that when every thing is thought to be secure, a high phrenzy suddenly arises, by which the patient is soon taken off unexpectedly; namely, from an absorption of the matter, and a translation of it to the brain. Hippocrates [m] relates the case of a patient, in which there seems to have been something of this nature. For he describes the patient as afflicted with an internal suppuration of the thorax, accompanied with a stertor, or weesing, which with the difficulty of respiration, seemed to indicate that a large quantity of matter was collected within. But, says he, *prope sexagesimum autem diem oculus sinister cum tumore excæcatus fuit, sine dolore: neque longe postea etiam dexter oculus, pupillæque admodum candidæ et siccæ fiebant, neque multo post hanc excæcationem mortuus est, non ultra septem dies, cum stertore et multa desipientia*; "about the sixtieth day the "left eye was blinded with a tumour, but without "pain: nor was it long after before the right eye and "its pupilla, became very white and dry, and in a "little time after this blindness, not more than seven "days, the patient expired with a stertor and light "headedness." For it seems very probable that the absorbed matter was by an unhappy translation carried first to the eyes and then to the brain, by which it destroyed the patient. It is therefore evident, that different diseases will arise according to the particular na-

[m] Epidem. Lib. VII. Ægrot. 30. Charter. Tom. IX. pag. 565.

ture of the viſcera, upon which the matter is depoſited; and as the ſame matter either compreſſes or corrodes the adjacent parts, which lie contiguous, it may either diſturb or totally deſtroy their functions. From hence it is alſo evident, that the greateſt prudence is required in conducting this matter; for if the abſceſs be opened before it is arrived to maturity, it may occaſion many bad conſequences, as was ſaid in the commentary on § 404. but if a diſcharge is not procured to the formed matter, then alſo the moſt fatal conſequences may attend. But the ſigns of a perfect maturation, with the treatment neceſſary to procure it, were deſcribed in the preceding aphoriſm.

It is from this abſorption of the matter that thoſe ſo frequently periſh, who have received a large wound, which daily affords a large quantity of matter, as when an aneuriſm has been cut out, or a limb amputated, *etc.* For if in theſe caſes the matter be frequently wiped off from the ſurface of the wound, where it is collected, the body will be deprived almoſt of all its nouriſhment, which will be that way diſcharged, ſo as to deſtroy the patient with a true maraſmus; but if the matter is left longer upon the ſurface of the wound, by being abſorbed, it will produce a purulent cacochymia, with all its conſequent maladies, unleſs the matter is waſhed out from the blood with which it is mixed, by drinking large quantities of deterging vulnerary decoctions. But ſometimes the patient's ſtrength is ſo weak as not to be capable of bearing a large quantity of ſuch decoctions, without being thrown by them into a dropſy, and in that caſe the event is almoſt conſtantly unhappy.

SECT.

SECT. CCCCVII.

THE integuments of the part suppurated, with such as are adjacent must be mollified, attenuated, and relaxed within and without, by the application of the same remedies (403.)

When an inflammation cannot be cured by a mild resolution, the best method that then remains, is to procure a suppuration, to obtain which, those curative indications are required, enumerated at § 402. and comprised there in six numbers. For in the first place the crude inflammatory matter is to be brought to a perfect maturation; concerning which we are now to treat, as also concerning the signs, by which we may be assured, that the maturation is compleated; and in the preceding aphorism, we enumerated those ill consequences which are to be feared, when a mature abscess full of laudable matter is not opened in time. The second curative indication was to mollify the part to be suppurated, with those adjacent, see § 402. numb. 2. concerning which we are to treat at present in this aphorism.

We observed that an inflammation is most frequently seated in the panniculus adiposus or cellular membrane, as it is sometimes called, (see § 374.) which membrane is covered externally with a thick skin and its cuticle, both which are to be cut through, or naturally divided, in order to make a way for the discharge of the matter, whence it readily appears, that it is in this case highly necessary to relax and mollify the integuments. But those remedies which were recommended in the commentary on § 403. for bringing the crude inflammatory matter to maturity, will also be sufficient for this purpose. For those glutinous substances recommended at numb. 2. of that aphorism, which stop up the pores, have also at the same time a power

power to relax and mollify the solid parts. While therefore such cataplasms or fomentations are applied externally, to the part to be suppurated, the integuments are as it were macerated and dissolved without, while at the same time, the matter excited to action, produces the same effect within; all which is still further promoted by that heat which invades the suppurating part, (see § 403. numb. 1). Nothing more therefore seems to be necessary to accomplish this curative indication.

SECT. CCCCVIII.

ALSO by these means (407.) the resistance of the integuments is diminished, while at the same time, the matter formed by the maturative remedies (403.) is either drawn or thrust outward.

The matter now formed, and confined in a close place, in which it is daily increased, being pressed by the adjacent parts, will by the laws of fluids tend that way where it meets with the least resistance. If now the integuments are so much weakened or relaxed by the application of the most emollient remedies, that they may very easily give way to the distending matter, that matter will elevate the integuments and tend outwards, without making itself any sinuous passages into the adipose membrane. All those remedies therefore which were recommended for maturating the crude matter of the inflammation, will also attract or give the formed matter a tendency outwards. For it was proved in the commentaries on § 134. that attractive remedies were such as diminished the resistance in any part, towards which the humours were to be derived.

SECT.

SECT. CCCCIX.

AND then things which are moderately acrid, emollient and oily, are to be mixed and applied together, that the dead integuments may be more easily opened and without pain.

A discharge is to be procured to the matter confined under the integuments, which therefore requires them to be divided, either by perforating with a lancet, or else by a spontaneous and gradual laceration made by the distending matter. But to effect this with the least pain, the most emollient and oily substances are to be applied, by which the integuments may be so extenuated, as to be almost destitute of sense, like a dead part. Therefore when an abscess is almost arrived to a state of maturity, and rises up to a sharp point, surgeons usually apply a pledgit spread with basilicon or some other very soft ointment, to mollify the integuments in the most protuberant part; for by thus relaxing the fibres, the pain is diminished, (see § 228. numb. 1.) which is generally severe enough in that prominent part of the tumour. Sometimes also there is a quantity of some moderately acrid substance mixed with the emollients, as yeast, Venice soap, honey, *etc.* which in some degree erode or destroy the macerated integuments, and occasion them to divide sooner. Thus washer-women who have been macerating their hands all day in strong soap-suds, have the skin of their fingers white and almost dead, insomuch that it frequently peals off. Forms of such like remedies as are here required may be seen in the *Materia Medica*, corresponding to this aphorism.

SECT.

SECT. CCCCX.

IN the next place the matter being discreetly preſſed towards the riſing part of the tumour, the ſcalpel or lancet is then to be entered into the lower part of the whiteſt, ſofteſt, and moſt prominent point of the abſceſs, until the diſcharge of matter demonſtrates that the knife has entered ſufficiently deep, which is then to be raiſed in an even manner ſo as to cut through the integuments with a longitudinal inciſion, or elſe by entering the point of the knife through the oppoſite part of the tumour, the middle of the integuments are to be cut through, avoiding at the ſame time the fibres and veſſels: after this the abounding matter is to be gently preſſed out, at ſeveral times ſucceſſively, taking care not to offend the wound either by admitting the air, or by the uſe of tents.

When the whole circumference of the part appears ſufficiently mollified, and all the ſigns denote that the maturation is compleated, if then the integuments do not open of their own accord, a diſcharge of the matter is to be procured by art, to prevent it from inducing thoſe conſequences which we mentioned at § 406. But in glandular parts an abſceſs is to be left longer before it is opened than in other parts, becauſe there is here greater danger of a ſcirrhus, if any part ſhould be left behind, which has not yet been brought to a maturation. Hence Celſus [a] in treating of the opening of abſceſſes obſerves, *ſi pus maturuit, in alis quidem et inguinibus raro ſecandum eſt: item ubicumque mediocris abſceſſus eſt: item quoties in ſumma cute, vel etiam carne vitium eſt, niſi feſtinare curandi imbecillitas*

[a] A. Corn. Celſ. Medic. Lib. XII. cap. 2. pag. 408, 409.

cogit.

cogit. Satisque est cataplasmatibus efficere, ut per se pus aperiatur, nam fere sine cicatrice potest esse is locus, qui expertus ferrum non est. "If indeed the matter should "come to maturity in the arm-pits or in the groins, "it ought seldom to be discharged by incision: and "the same is also to be universally observed when the "abscess is but moderate, and when the disorder is "seated either in the external skin or in the fat, unless "the weakness of the patient, should require it to ex- "pedite the cure. It is in these cases sufficient to ap- "ply cataplasms, by which the matter may make its "own way; for the part which has not suffered the "action of the knife or cautery may remain with lit- "tle or no scar after the cure." From whence it appears, that the spontaneous aperson of the abscesses is not only preferable when they are seated in glandular parts, but also when they are in danger of producing any deformity by a scar. But then a wound made by a lancet may be afterwards better healed, than if a larger portion of the skin was to be destroyed, or wasted by the contained matter. But why Celsus should observe that an unsightly scar often remains after an abscess has been opened by an instrument of iron, is very apparent from what follows in the same place: for when the matter is lodged very deep, he orders the abscess to be opened by an actual cautery; and otherwise when the skin is very much extenuated, he would have all that part of it cut out which covers the matter. He likewise extirpates the skin in the same manner when it looks pale; for then he says it will become dead and useless, and will be therefore more commodiously cut off.

To procure a discharge to the matter which is collected in a mature abscess, we must endeavour to perform it with as little trouble to the patient, and with as little danger and injury to the adjacent parts, as we possibly can: for we are to divide no more than the common integuments, which are distended and elevated by the matter confined beneath. Hence it is usual for

for ſurgeons to preſs very gently with their fingers upon the whole circumference of the ſuppurated tumour, in order to make the integuments recede as much as poſſible from the ſubjacent parts: and as ſome part of the tumour is generally raiſed to a point, as was ſaid at § 405. therefore the ſcalpel is to be entered principally into that part as the integuments are there more extenuated, and being almoſt dead, they may be eaſily perforated almoſt without pain, eſpecially if that point of the tumour has been before treated by the application of moderately acrid and fat ſubſtances, as we directed under the preceding aphoriſm. But to do this with the more advantage, the inferior or moſt depending part of the tumour is to be choſe for the aperture, that the matter may be diſcharged by its own weight: but in this, attention muſt be alſo given to the poſture which the part will require after the opening has been made. For as Celſus [b] obſerves, *Danda (enim) opera, ut imus ſinus exitum habeat; ne quis humor intus ſubſidat, qui proxima et adhuc ſana rodendo ſinuet*; "for we muſt endeavour "to let the ſinus have an opening at its bottom, leſt "any humour ſhould be confined within, and inſinuate "itſelf farther, by corroding the adjacent parts, which "are as yet ſound." But if the point of the abſceſs is arrived at maturity in its upper part, and the integuments appear there ſofteſt and whiteſt, it will be beſt to make the opening in that part, rather than in one which is more depending, but has its ſkin as yet inflamed and very painful, ſo that it cannot be divided without frequently producing much trouble to the patient and the ſurgeon. For the opening being made, the matter may be entirely diſcharged from the abſceſs, and prevented from making any ſinuous paſſages through the panniculus adipoſus, by changing the ſituation of the part with a gentle compreſſion, and a

[b] Celſus ibidem.

judicious

judicious application of compresses and bandage, according to the nature of the part.

So soon as the knife has penetrated the integuments, it enters into the middle of the purulent matter, which then immediately discharges itself by the sides of the knife, more especially if the integuments were at the same time stretched by a gentle pressure upon the subjacent matter. But when there is a very large quantity of matter, it is best to enter the knife pretty deep, that the wound may be afterwards enlarged, by an even incision made in elevating its point. For the same reason likewise, when it may be safely performed, the knife is thrust from one side of the prominent part of the abscess to the other, and then by elevating it, the superincumbent integuments are divided at once to make the opening the larger, which can never be prejudicial. For unless the opening is made thus large, very great portions of the cellular membrane will be thrust out, almost in a gangrenous state, together with the matter, whence the aperture will be obstructed, and a new incision again required. Add to this, that when the matter is discharged, the integuments which were before distended, will be contracted into wrinkles, so as to very much diminish the opening which has been made, and therefore it may be taken almost for a general rule, always to make the incision as large as possible, in the opening of an abscess, provided it can be done without danger of injuring the subjacent parts. But when the matter is lodged immediately under the skin, it is very evident that then there will be no need to enter the knife to any considerable depth. But sometimes the greatest caution is necessary, when the matter is concealed in parts very remote from the skin; for it will be bad to make an incision upon an abscess without obtaining the discharge required, but it will be often more dangerous to enter the knife deeper into the part, than was at first thought necessary, and therefore in such difficult cases the skill and dexterity of the surgeon are more necessary and apparent.

For unless he is well acquainted with the situation of the parts from anatomy, he will be always trembling either with a vain fear, or else with a rash assurance he will despise the danger of which he is ignorant. For as an inflammation is seated most frequently in the panniculus adiposus, as we have several times observed before, and as that membrane insinuates itself betwixt all the muscles, it is evident that the matter may sometimes lie very deeply concealed without causing any apparent defect in the integuments. The signs of a deep inflammation having proceeded, and having been afterwards attended with the signs of a consequent suppuration, with a fluctuation of the matter upon pressing the part, will afford some light into those obscure places. A very remarkable case of this nature is related by the celebrated Le Motte[e]. A woman was confined to her bed for nine months after a suppression of her lochia, being obliged to continue with her body inflected, in order to lessen the very acute pains; for she always continued in the same posture day and night, with her heels drawn up towards the nates, and her face bowed down to her knee. As the pain was seated chiefly in the middle of the hypogastric region, betwixt the navel and the pubes, therefore a more diligent examination was made in that part, by which the surgeon perceived a sort of undulation, though there was neither hardness nor tumour, nor any kind of change in the colour of the integuments. But by long experience, he determined from his knowledge in other diseases of the like nature, that there was here concealed a deep abscess which was the cause of all the maladies; and though he was opposed by four surgeons who had attended the unhappy woman before, yet he insisted upon making an opening in that part, which with great caution he performed, till he had penetrated into the cavity of the abdomen. But notwithstanding this opening was made,

[e] Traité complet de Chirurgie. Tom. I. pag. 280.

no

no matter could be discharged even though the abdomen was compressed, the patient held her breath, and the posture of the body was altered. The excellent surgeon being astonished at his ill success, went away privately derided by the other surgeons, and candidly confesses that he did not sleep all the night. The next morning upon removing the apparatus which was applied the day before to the wound, he had the satisfaction to see a large quantity of matter discharged, though he could not understand where it lay concealed. The matter continued to discharge itself daily, for about the space of six weeks, and the woman by that time perfectly recovered of so desperate a disorder. She afterwards bore children, and was able to walk very well, only inclining a little towards the right-side, where the disorder had been seated. I remember to have seen a case of the like nature, when a surgeon opened a deep abscess in a woman's breast, which did not discharge so much as one drop of matter, although the scalpel had entered to the depth of above an inch; but yet a few hours after a large quantity of matter discharged itself spontaneously through the opening. From hence it is evident that the diagnosis in such a case ought not easily to be changed immediately; when after maturely considering all the circumstances, it is concluded that the part ought to be perforated or laid open; for although the point of the scalpel should not have penetrated into the cavity of the matter, yet the matter will be afterwards derived towards that part, as there will be there a less resistance.

Avoiding the fibres and vessels.] If the confined matter is lodged immediately under the skin, or if, as Celsus [d] terms it, the matter is conjoined to the skin; it is evident enough that there can be no danger of injuring any considerable fibres or vessels as the matter elevates the skin from the subjacent parts; nor has it ever yet appeared that a true suppuration has succeed-

[d] Lib. VII. cap. 2. pag. 409.

ed in the substance of a muscle, but that it is always lodged in the panniculus adiposus, for though Ægineta [e] says, *quod abscessus sit corruptio et permutatio carnium aut carnosarum partium, veluti musculorum, venarum, arteriarum*; "that an abscess is the corruption, or alteration of the flesh or fleshy parts, as the muscles, veins, and arteries;" yet we are taught by daily observation, that after the panniculus adiposus has been consumed by large suppuration, or even gangrenes, yet the muscles have appeared extremely clean and intire. It is indeed true, that we sometimes observe extraordinary changes, not only in the tunica adiposa, but also in the substance of the muscles themselves; but then upon opening such a tumour there is not a discharge of matter, but a liquor of a different kind, whence it would seem that those disorders ought not to be ranked among the class of suppurations or abscesses. A remarkable case of this nature is related in the *Medical Essays* of *Edinburgh* [f], of a woman who had a tumour for some months upon the external part of the leg, more prominent and soft in the middle, with a manifest fluctuation when it was pressed by the fingers. As the skin of the part looked red, was attended with an acute pain, a hectick fever, night sweats, and a diarrhœa returning every third day, *etc.* it therefore seemed most adviseable to incide or open the part. And therefore after maturating cataplasms had been applied for two days, and the integuments were much extenuated, so that an evident fluctuation might be perceived, an incision was then made sufficiently deep, to the length of an inch and a half; but though the tumour was thus opened, it did not discharge a drop of matter, but there flowed out about two or three ounces of mucus. On the day following a fungous mass appeared, sprouting up through the opening, which being removed, grew again, and after a large quantity of this substance had been cut off, upon introducing

[e] Lib. IV. cap. 18. pag. 64.
[f] Medical Essays, Tom. I. p. 234.

the

the probe, it passed quite through the substance of the leg, till it touched the skin on the opposite side. A few days afterwards the woman died, and the skin of the affected leg appeared sound, but the panniculus adiposus, together with the muscles, were changed into a fungous mass, so that none of the muscles could be distinguished, even by a diligent examination. The periosteum had here receded on all sides from the bones. From this case it is evident that the muscles may be changed into a shapeless mass by diseases, but yet there was no matter found there, which is very remarkable. Perhaps Hippocrates [g] might intend the same kind of abscess, when he says, *Verum, ut summatim dicam, cætera quoque omnia, quæ mucosa sunt, et mucos producunt, utpote glutinosa, ubi tangantur, subito in hanc vel illam partem sub digitis elabuntur, quam ob rem profundius inveniunt hæc Medici, quam putant*, "But to speak in brief, all other parts which are "mucous or produce a mucus, as being glutinous "when they are touched, they suddenly slip from un- "der the fingers to this or that part, and therefore the "physicians find the matter seated deeper than they "imagined. For in this place he treats of a fracture of the ear, followed with a suppuration; and observes that if the incision ought to be made, it should not be small, because the matter is more deeply seated than any one would imagine; and a little before he observed, that cataplasms applied to the ear, were prejudicial, as they excited abscesses with a great deal of mucus and troublesome suppurations; and then he subjoins the sentence which we have just quoted from him.

There does not therefore seem to be much danger of injuring the fibres in opening a mature abscess, and therefore that caution is needless which is so largely described by Fabricius ab Aquapendente [h], almost in

[g] De Articulis. Charter. Tom. XII. pag. 363.
[h] De Chirurgicis Operat. cap. 107. pag. 654.

every part of the body of which he treats; that is, to make no incision but according to the course of the subjacent muscular fibres; for even that same author confesses afterwards in the same chapter [i], "that those "who are ignorant of anatomy cannot err in the "opening of an abscess, by reason of the quantity of "matter which elevates the skin, and secures the sub-"jacent parts from the knife."

The abounding matter is afterwards to be gently pressed out at several times.] In the larger sort of abscesses, in which there is a very great quantity of matter collected, it does not seem to be always safe to discharge the matter intirely at one and the same time. For all the parts which invest the abscess, were before very much compressed by the matter, and if they were freed from the pressure one moment, they would become very flaccid, and admit a great quantity of blood in their vessels, so that less blood would be sent to the brain and cerebellum, whence a fainting and death itself might follow. The same danger is also at hand, if a part is suddenly set at liberty from the pressure which it received from any other collected humour; whence Hippocrates [k] observes, "that those expire "who have the water or matter intirely discharged, "after the operation of perforating or cauterizing in "an empyema or a dropsy." But if the abscess is seated in such a part of the body, that the parts may be compressed by bandage, in proportion to the quantity of matter discharged, then the greatest evacuations may be safely performed at once, as we shall declare when we come to treat of the cure of an ascites by paracentesis. Nor will it be at all injurious to leave a quantity of matter in the abscess, for its cavity being covered as it were with a natural balsam, will be fomented and deterged, the half dead ends of the vessels will be separated, and the whole better disposed to

[i] Pag. 662.

[k] Aphor. 27. Sect. VI. Charter. Tom. IX. pag. 263.

heal,

heal, as we said more at large in the history of wounds, § 158. numb. 7, 8, and 9. It is only necessary not to let so much matter remain as to injure the parts by distending them, or so as to occasion it to penetrate into the panniculus adiposus; both which will be prevented, if the opening is left free, and made in such a part of the tumour, that the redundant matter may flow out by its own weight. Whence great caution is to be used that the opened abscess,

Be neither molested by the admission of the air, nor by the use of tents.] After the abscess has been opened, even though all its matter was discharged, yet more will be collected there again in the space of about four and twenty hours, and sometimes sooner, which will also require to be discharged in the same manner. Therefore surgeons who were fearful, lest the lips of the divided abscess should unite too soon, usually introduce tents to prevent the orifice from concreting. But such tents formed of dry scraped lint, swell very much by absorbing the contiguous humours, by which means, as they are of a conical figure, they are thrust out in a little time, or else if they are retained by the application of plaisters and bandages, they stop up the orifice like a cork, and prevent any discharge of the matter, which therefore endeavours to make itself new passages into the panniculus adiposus, which is too easily dilatable. Besides, these tents gradually lacerate and distract the lips of the opening, while they swell by absorbing the humours; from whence a painful tumour and a new inflammation often arises. It is therefore evident that tents are in this case either useless or pernicious. But when the apparatus or dressings are renewed, and the tent is extracted to discharge the matter, there is then a passage given to the air into the empty cavity; but how pernicious the air may prove by drying up the extremities of the tender vessels, which are naturally open, has been said in the commentaries on § 204. and 245.

The beſt method of all therefore will be to keep the opening always covered with a flat pledgit, ſo that the matter may continually flow out with eaſe, taking care alſo that neither the bandages nor plaiſters preſs upon the orifice; but rather make a gentle preſſure upon the circumjacent parts, by an artificial application of compreſſes and bandage; and thus the matter may be derived towards the open orifice, which is free from any manner of preſſure. But the uſe of tents in open abſceſſes ſeems to have been long ago ſuſpected, even by Celſus [f], when he ſays, *Tum, ſi quæ in alis, vel inguinibus ſunt, ſine linamento nutrienda ſunt. In cæteris quoque partibus, ſi ima plaga exigua eſt, ſi mediocris ſuppuratio fuit, ſi non alte penetravit, ſi febris non eſt, ſi valet corpus, æque linamenta ſupervacua ſunt. In reliquis, parce tamen, nec, niſi magna plaga eſt, imponi debent.* "For if any of them are ſeated either "in the arm-pits or groins, they are to be incarned "without lint. Alſo when in other parts the bottom "of the opening is but ſmall, if the ſuppuration was "but moderate or ſuperficial, and not attended with "a fever or diſorder of body, the uſe of lint is even "there unneceſſary. In others lint is to be uſed but "ſparingly, or not at all, unleſs the wound is large." See what has been ſaid concerning the ill effects of tents in the commentary on § 299.

SECT. CCCCXI.

LAſtly, the abſceſs is to be treated with medicines which mundify, ſuppurate, digeſt, heal, deterge, or dry, according to the different nature of the caſe, and agreeable to the doctrine of wounds from § 192, to 220.

We come now to treat of thoſe curative indications which are mentioned in the two laſt numbers of § 402.

[f] Lib. V. cap. 28. pag. 327.

namely

namely in what manner the opened abſceſs is to be cleanſed and reduced to the ſtate of a clean wound. For the whole internal ſurface of the abſceſs has been macerated for ſome time in the confined matter, by which means it is almoſt conſtantly more or leſs diſeaſed, as was ſaid in the commentary on § 402. numb. 5. It will be therefore neceſſary to cleanſe this internal ſurface, and ſeparate all thoſe parts of the ſolids and fluids, which are ſo far corrupted as to impede the union of the other ſound parts. But the ſurface of the abſceſs will be the fouleſt of all, if the matter by being too long confined, has changed its balſamic quality into an acrimony; for then it in a manner conſumes the adjacent parts of the ſkin and panniculus adipoſus: but it would be impoſſible to unite or heal the parts thus foul before they are cleanſed, as hath been very juſtly obſerved by Galen [a], when he ſays, *quum vero cutis in ſuppurationibus amplius extabuerit, ita ut attritis veſtium fragmentis ſimilis reddatur* (ὡς ῥακώδες γενέσθαι) *difficulter ſubjectis corporibus coaleſcit; itaque emiſſario largiore facto ulcus neceſſario curandum eſt.* "But when "the ſkin is ſo much extenuated in large ſuppurations, "that it reſembles the rags of a worn-out garment, "it very difficultly unites with the ſubjacent parts, and "therefore it will be neceſſary to cure the ulcer by en"larging its opening or diſcharge." But what remedies are required to depurate a ſordid ulcer, and to reduce it to the ſtate of a clean wound, has been declared before, in the hiſtory of wounds, eſpecially in the commentaries on § 204. and the following to 210.

[a] Method. Med. ad Glaucon. Lib. II. cap. 9. Charter. Tom. X. pag. 384.

SECT. CCCCXII.

IF the patient is poſſeſſed with a needleſs fear of the knife, a cauſtick may be applied to the part which points (410), and the eſcar being ſoftened with freſh butter, may be afterwards ſeparated, and the reſt of the treatment conducted as before (at § 410, 411.)

A mature abſceſs may be moſt ſafely opened by the ſcalpel; but ſometimes the ſurgeon is concerned with a patient of ſo puſillanimous a condition, as even to faint away at propoſing the knife; tho' even in theſe caſes, it is beſt to deceive the patient and open the abſceſs by inciſion when it is not ſuſpected. Various machines have been invented by ſurgeons for this purpoſe, as the concealing of a lancet in a ring upon their fore-finger, or elſe a lancet being fixed with its points through a plate of metal, the plate is then covered with ſome cataplaſm or ointment, and being applied to the part, the buſineſs is eaſily performed, by preſſing the point gently over the part to be divided. There are ſeveral other contrivances of this nature to be met with in Parey [a] and others. But if even by this means the neceſſary opening cannot be made in a mature abſceſs, nothing then remains but to apply a cauſtick, or potential cautery as it is called by the ſurgeons, to the pointing part of the abſceſs: of theſe cauſticks there are ſeveral kinds in the ſhops, ſuch as the lapis infernalis, or the common cauſtick compoſed of quick lime and pot-aſhes, (ſee the *Materia Medica* correſponding to this aphoriſm) which are thoſe chiefly in uſe. Firſt a plaiſter is applied to the part, in which there is a ſmall aperture correſponding to that part of the ſkin to which the cauſtick is to be applied; and to this aperture the cauſtick is then fixed and retained by

[a] Livre VII. chap. X. pag. 167.

applying

applying another plaister over the whole, and thus the apparatus is left on for an hour or two, or till the eschar is burnt sufficiently deep. After this the eschar is separated from the living parts, by dressing it with basilicon, fresh butter, or the like, and then the matter is discharged through the aperture as before made, after which the cure may be conducted as where directed. But it is certain that those who are afraid of the knife suffer more pain from the caustick; for a mature abscess is divided by the scalpel in a moment, whereas a caustick is obliged to lie upon the part an hour or two, or even longer, and after all there is still a considerable pain felt when the eschar is gradually separated from the contiguous living parts; to which add, that a caustick usually produces a greater deformity in the cicatrix.

Of Fistulæ.

SECT. CCCCXIII.

From what has been said, the origin, cause, nature, situation, and effects of sinuses and fistulæ may be understood (§ 406.)

When we enumerated the ill consequences from a too long retention of mature matter in an abscess § 406. we observed that the matter by its weight, motion, and acrimony, might create sinuses and fistulæ of different kinds in different parts of the body. We are therefore to treat of these sinuses and fistulæ in the following aphorisms.

But the word sinus is used among physicians and surgeons, to denote a cavity in the soft parts of the body, which have been removed from their contacts with each other, by the matter collected in an abscess, afterwards discharged either by a natural or artificial opening. For such is the definition of a sinus given by Galen [a] in treating of this subject, when he

[a] Commentar. 2. in Lib. Hippocrat. de Medici Officina, textu 27. Charter. Tom. XII. pag. 64.

say

ſays, *Quoad enim pars ita affecta nullam aperturam habet verſus exteriorem ſuperficiem, abſceſſiſſe ipſa quidem dicitur: affectio autem abſceſſus vocatur. At ubi aliqua ex parte aperta eſt, ſic ut excernatur contentus humor, affectio non amplius abſceſſus, ſed ſinus jam appellatur*; "For when the part thus affected has no opening towards the external ſurface of the body, it is then "ſaid to have abſceded, and the diſorder itſelf is "termed an abſceſs: but when there is an aperture "ſo as to diſcharge the contained humour, the diſorder is no longer called an abſceſs but a ſinus." Now it follows from this definition, that a ſinus muſt neceſſarily follow after every abſceſs; but yet it has been cuſtomary only to call it a ſinus when the ſides of the abſceſs which has been opened and freed of its matter, do not unite ſpeedily together, even though they remain contiguous, but continue a long time divided; and therefore there will be a collection of freſh humours made every day in that cavity, which will retard the cure. Hence we find the following definition of a ſinus given us by Galen [b] in another place, *Quum corpora pus excoriat, et continentia a ſubjectis ſeparat ac diducit*; *deinde eo (pure) quomodocumque evacuato, ſeparata nequeunt priſtinam conſtitutionem recuperare, affectio ſinus appellatur*: "As the matter excoriates the "parts, and ſeparates or diſſolves the containing parts "from thoſe which are ſubjacent; then that matter "being ſome way evacuated, the divided parts cannot recover their former continuity, and the diſorder is termed a ſinus." The like he alſo ſays in another place [c]. For after having taken notice, as we ſaid in the commentary on § 411. that the ſkin is ſo waſted in ſuppuration, as to reſemble the fragments of a worn-out garment, and very difficultly unites with the ſubjacent parts; he then immediately adds in the

[b] Galen. de Tumor. præternatur. cap. 4. Charter. Tom. VII. pag. 316.

[c] Method. Med. ad Glaucon. Lib. II. cap. 10. Charter. Tom. X. pag. 485.

beginning of the following chapter; *Quum amplius subjectis sinus corporibus cutis coalescere non potest, ejusmodi affectus appellatur.* "As the skin can now no more "unite with the subjacent parts, such a disorder is called "a sinus." Even this same definition of a sinus is given us almost in the words of Galen by Paulus Æginetа [d].

But a fistula differs from a sinus in that it is narrower and generally of a longer standing, having its orifice and internal surface frequently covered with a callus. Hence we have the following definition of a fistula given by Æginetа [e], *fistula sinus est callosus, plerumque ex abscessibus nascens, ducta ab arundineis fistulis translatione appellata.* "A fistula is a callous sinus, "generally arising from an abscess, and deriving its "name, from a reed-pipe." And in another place he adds, [f] that fistulæ generally arise from abscesses which have not been well cured. But the latin Hippocrates, Celsus [g], having told us in a few words, that fistulæ arise from abscesses and other kinds of ulcers, defines them by saying, *Id nomen est ulceri alto, angusto, callosо*; "this is the name of a deep, narrow "and callous ulcer."

Origin.] The rise of sinuses and fistulæ is evident enough from what has been said in the commentaries on § 406. for a phlegmon being changed into an abscess if its matter is too long confined or discharged by too narrow or high an opening, so that it cannot easily escape, it gives birth to sinuses and fistulæ.

Cause.] That is, good matter by its weight and bulk making a passage into the cellular membrane which is very easily dilatable; or else the same matter corrupted by stagnating, and rendered so acrimonious as to corrode the adjacent parts.

[d] Lib. IV. cap. 48. pag. 69. versa.
[e] Lib. IV. cap. 49. pag. 70.
[f] Lib. VII. cap. 77. pag. 93. versa.
[g] A. Corn. Cels. Med. Lib. V. cap. 28. n°. 12. pag. 328.

Their

Their nature.] Consisting in a preternatural cavity amongst the soft parts, removed from their usual contacts by a collection of purulent matter, ichor, sanies, *etc.*

Seat.] This is always in the panniculus adiposus; nor do I know that it has ever appeared from any credible observations that the proper substance of the muscles has been at any time pervaded by fistulæ. We observed in the commentary to § 374. how largely the panniculus adiposus is extended, so as to involve the whole body, and almost every particular part thereof; it being not only continued round the muscles and tendons, but also inserted betwixt the sub-divisions of the muscles into their lesser portions, even as far as the eye can trace them. From whence it is evident that sinuses and fistulæ may often turn and wind in a surprizing manner, and often penetrate to a very great depth from their opening, as surgeons frequently find and testify by many observations. A young man aged twenty two years, was troubled with a most acute pain, for above the space of six weeks, which invaded the loins, inguen and nates of the right-side, obliging the patient to lie night and day upon his back with his knees drawn up, and his feet bent towards the nates. After the best remedies had been used without success, no change of colour could be observed in the skin of the painful parts, nor any alteration of their figure; but at the side of the vertebræ of the loins, there was a deep undulation to be perceived (like that of matter) betwixt the spine of the os ilium, and the last of the false ribs. This part being deeply incised with a scalpel to the length of near three inches, discharged above six pounds of pure matter: and an incredible quantity of matter was also discharged afterwards in the latter part of the same day from the opening, which overflowed the patient's bed, unknown to him, but to the great relief of his pains. When the surgeon removed the dressings and pressed the abdomen, there was again a large quantity of matter discharged, and still much more, when the leg and thigh of the same side were

were compreſſed, though there was no apparent tumour in thoſe parts. On the following days when all the matter had been diſcharged as near as poſſible, by compreſſing the thigh and abdomen, there was ſtill a large quantity of matter again expelled by beginning a compreſſure at the foot and continuing it up to the knee [b]. From this ſurprizing caſe it appears that good matter not at all ill conditioned, may by its weight only, as it ſhould here ſeem, make itſelf paſſages from the loins, down even to the bottom of the foot; inſomuch that though the whole habit of the patient's body was ſo waſted by this large ſuppuration, that one might eaſily ſpan or graſp the top of his thigh with one's hand; yet within five months after the opening made, he was perfectly recovered, and in two months more he entirely regained all that he had loſt, and even ſeemed to be fatter than before he had the diſeaſe.

I ſaw a caſe of the like nature which had not ſo ſucceſsful an event. A ſoft tumour aroſe on the left-ſide, even with the os ilium, and at about the diſtance of two fingers breadth from the ſpina dorſi, in a healthy briſk and middle aged man without any manifeſt cauſe. The late celebrated Boerhaave being conſulted, ordered the tumour to be divided by a large inciſion with a ſcalpel, but the fearful patient reſiſted immediately upon the firſt touch with the knife, and could not be prevailed upon either by his friends or the threatning events of his diſorder to ſuffer the inciſion to be made an end of; for there was but a ſlight puncture made which ſcarce entered the ſkin, ſo that no matter was diſcharged at that time, but yet by the application of emollient catalapſms for two days to the wounded ſkin, an incredible quantity of matter made its way out. As all the functions of the body appeared in good condition, there was great hopes of a cure, but the plentiful diſcharge of matter continued daily,

[b] De la Motte Traité complet de Chirurgie, Tom. I. pag. 357, &c.

and

and the ſurgeon preſſing the neceſſity of dilating the ſmall opening, the patient after delaying many days, at length conſented, but did again prevent it from being enlarged as much as it ought, by the reſiſtance he made upon feeling the pain, for he would not ſuffer himſelf to be held by any aſſiſtance. In the mean time the quantity of matter ſeemed to diminiſh for ſome days, but again after a while an exceeding large quantity of matter vented itſelf unexpectedly, almoſt like a torrent. The ſurgeon with much difficulty obtained leave of the patient to examine which way the ſinus tended by his probe, which he could eaſily paſs upwards under the integuments to the ribs; and as the miſerable patient obſtinately perſiſted rather in ſuffering death, than to admit of an eaſy inciſion, therefore a new opening was made by the application of the common cauſtick to that part, where the end of the probe met with a reſiſtance. But though all proper treatment was given with compreſſes, bandages, a convenient poſture of the body, *etc.* it was yet to no purpoſe, for the matter continued diſcharging in ſuch quantities as to daily overflow the compreſſes, bandages, and even the bed itſelf. In the mean time the patient's body was waſted with a hectick fever, his appetite in the mean time remaining intire, and his bowels neither too much conſtipated, nor too looſe. His body being at length totally emaciated, after ſome weeks time, a ſoft tumour appeared in the right inguen as high as the top of the os pubis, by opening which, ſeven pounds of clean matter were diſcharged; and yet there was alſo a continual diſcharge of matter from that aperture in the groin, as well as from the two others in the back, which at length ſo much exhauſted the patient that he quietly expired, even though his appetite remained good to the laſt.

As I very much wondered from whence ſo large a quantity of matter proceeded, and could not imagine that it came from the cavity of the abdomen, through the aperture in the groin, which was the opinion of the

the ſurgeon, though there was no apparent tumour of the abdomen, nor any defect in the chylificative organs throughout the whole courſe of the diſeaſe; I obtained leave therefore of the patient's friends to examine the body.

We introduced a probe through the two openings in the back, nor could we make it paſs to any conſiderable length: but when we entered the probe into the opening which had been made in the groin, it paſſed its whole length without uſing any force. After drawing out the probe, we introduced a leaden plummet through the ſame orifice, and paſſed it gently upwards till it met with a reſiſtance, and then by laying open the tract of the probe by inciſion, we found that it paſſed not into the cavity of the abdomen, but that it went up backward above the pſoas muſcle, under the peritonæum and right kidney; nor could we find any communication betwixt this ſinus and the two openings which were made in the back. In the cavities of the thorax and abdomen, there was not ſo much as a ſingle drop of water to be found; and as we had not obſerved any diſturbance in the functions of the brain, during the whole courſe of the diſeaſe, we therefore refrained from opening the cranium. From hence it is ſufficiently evident, that all this matter was lodged in the panniculus adipoſus only, ſince none of the other parts appeared viciated, and there were no apparent ſigns of a ſuppuration preceding, nor of any matter contained in the larger cavities of the body.

The effects of ſinuſes and fiſtulæ, are like thoſe, which we enumerated in the commentary on § 406. reſulting from too long a confinement of matter in a mature abſceſs: For the matter being retained in ſinuſes and fiſtulæ, from whence it can hardly ever be intirely diſcharged, it is there attenuated and putrified by ſtanding, ſo as to degenerate into an acrid ſanies, and this ſooner than in a cloſe abſceſs, becauſe there is here an acceſs given to the air. The ſides therefore of ſinuſes and fiſtulæ will be much injured by this corrupt matter, which

which will so much alter them, that it will be afterwards very difficult to cleanse and reduce them to the state of a pure wound, which yet is absolutely necessary to procure an union of the divided parts; and the matter there residing, will also prevent the union of the parts by interposing like a foreign body. It is also from hence apparent, that fistulæ must be the worse conditioned as they are of longer standing, and as they approach nearer to some parts, by an erosion of which we may justly foresee much danger or slowness and difficulty in the cure. Hence Hippocrates [b] treating of this subject, says *Fistulæ difficillimæ sunt, quæ in cartilaginosis et carne vacuis locis fiunt, cavæ sunt, cuniculos agunt, et ichore semper manant. Caruncula autem in eorum osculo est. Facilius autem curantur, quæ in mollibus, carnosis, et nervorum expertibus locis contingunt.* "Those fistula's are very stubborn, which "are seated in parts cartilaginous and destitute of "flesh; as are those also which are cavernous, and "burrow into the parts, continually discharging an "ichor. But there is generally a caruncle in the "mouth of those fistula's. But those are more easily "cured, which are seated in soft fleshy parts destitute "of nerves." A very accurate but somewhat fuller prognosis of a fistulæ, is given us by Celsus [k], when he says, *Expedita curatio est in fistula simplici, recenti, intra carnem. Adjuvatque ipsum corpus, si juvenile, si firmum est. Inimica contraria his sunt: itemque, si fistula os, vel cartilaginem, vel nervum, vel musculos læsit; si articulum occupavit; si vel ad vesicam, vel ad pulmonem, vel ad vulvam, vel ad grandes venas arteriasve, vel ad maxillas, guttur, stomachum, thoracem penetravit. Ad intestina quoque eam tendere, semper periculosum, sæpe pestiferum est. Quibus multum mali accedit, si corpus vel ægrum, vel senile, vel mali habitus est.* "The "cure is short in a simple fistula which is recent, and "seated in the flesh. The cure will be also assisted "by the body itself, if that is strong and young.

[i] Coac. Prænot. n°. 511. Charter. Tom. VIII. pag. 882.
[k] Lib. V. cap. 28. n°. 12. pag. 328, 329.

"But

" But the contrary of thoſe oppoſe the cure, which " will be alſo difficult if the fiſtula has injured a bone, " cartilage, nerve, tendon, or muſcle, as alſo if it " is ſeated in a joint, or if it has penetrated to the " bladder, lungs, womb, large arteries, or veins, or " into the fauces, throat, ſtomach, or thorax. It is " alſo conſtantly dangerous, and even frequently fa- " tal, for a fiſtula to tend to the inteſtines. Fiſtulas " are alſo rendered much more malignant when the " body is indiſpoſed by diſeaſe, old age, or a bad " habit."

SECT. CCCCXIV.

AN opened ſinus (413.) may be eaſily diſcovered; but a cavity which is as yet cloſed, is diſcoved by the ſoftneſs to the touch.

We come now to enquire by what ſigns one may diſcover a preſent ſinus or fiſtula; but theſe are ſufficiently evident, when they open outwards in ſome external part of the body. For if a large quantity of matter is diſcharged from ſuch a ſmall opening, or may be forced out from thence by preſſure, it is from thence evident that there muſt be a large cavity for containing that matter. But to diſcover which way the ſinus tends, Celſus[1] orders an examination to be made with a probe, where he ſays, *Ante omnia autem demitti ſpecillum in fiſtulam convenit, ut quo tendat, et quam alte perveniat, ſcire poſſimus, etc.* " But firſt of " all it will be proper to probe the fiſtula, that we " may know to what part, and how deep it pene- " trates," *etc.* And by the ſame method he would alſo have it diſtinguiſhed whether or no the fiſtula has penetrated to the bone, as alſo whether the bone itſelf is carious. But in order to be aſſured whether a fiſtula, opening with but one orifice externally, divides itſelf afterwards into ſeveral branches or

[1] Ibid. pag. 329.

ſinuſes within, he directs [b] the following method to be taken: *Corporis inclinatio docet, num in plures partes fiſtulæ penetrarint; quia ſæpe, cum quis aliter decubuit, aliterque membrum collocavit, pus ferri, quod jam deſierat, iterum incipit; teſtaturque, non ſolum alium ſinum eſſe, ex quo deſcendat, ſed etiam in aliam corporis partem eum tendere.* "An inclination of the body "will demonſtrate whether or no a fiſtula penetrates "into more parts than one; becauſe frequently when "a patient lies in a different poſture, or places the "limb in a different manner, the matter which then "ceaſed to diſcharge itſelf will again flow out, and "not only teſtify that there is another ſinus from "whence it deſcended, but alſo that the ſinus tends "into another part of the body." But the beſt of all methods for diſcovering the capacity and different courſe of ſinuſes and fiſtulæ ſeems to be by a prudent and gentle injection of warm water with a ſyringe. For the water will eaſily inſinuate into all the meanders of a fiſtula, which if it tends outwards under the integuments, will demonſtrate its different courſe by elevating the ſkin into a tumour: but if the ſinus or fiſtula deſcends deep, the quantity of water injected, will then only demonſtrate the magnitude or capacity of ſuch a preternatural cavity, nor can much more be diſcovered by the uſe of a probe, which if rudely thruſt through the orifice of a fiſtula, often runs into and lacerates, the panniculus adipoſus, ſo as to make ſinuſes which were not before; nor is it poſſible to diſcover the length of a fiſtula by this means, when in a turning or winding courſe.

But when a ſinus is as yet cloſed, the diagnoſis of it is ſtill more difficult, eſpecially if its ſituation is very deep: but ſome light may be had from the ſigns of inflammation preceding, and the marks of a ſuppuration following, and if after theſe a ſoftneſs and fluctuation is perceived by the touch, we may be cer-

[b] Ibid. pag. 330.

tain

tain enough that there is a sinus. Add to this, that a suppuration of any moment seldom lies long concealed in any part of the body without producing a hectic fever. But great prudence is required in determining this matter, to avoid mistaking a latent aneurism or a varix for a deep suppuration, which has sometimes happened; but a skilful surgeon cannot easily run into such an error, if he first carefully considers the origin and progress of the disorder. It must however be confessed, that abscesses have been sometimes observed so latent or deeply situated, as to occasion the most skilful surgeon to be sometimes in a doubt, as is evident from the extraordinary case mentioned in the commentary on § 410. from the excellent surgeon Le Motte, who has candidly described the case, with many others of the like nature.

SECT. CCCCXV.

Fistulas are cured by opening them in their lower part, by filling their cavities with melted digestives, chose according to the nature of the case, by the injection of detersives, and by bandage gradually pressing from the bottom upwards, or towards the opening: but the integuments are soonest divided upon a director or grooved cannula, or by a silver wire, or lastly by the syringotomus.

The cure of all sinuses and fistulas, requires in general the following. 1. To procure a free passage to the matter, and to prevent it from standing long so as to corrupt in the sinus or fistula. 2. To cleanse or deterge the internal surface of the cavity of the sinus or fistula, and reduce it to the state of a clean wound. 3. To bring the separated parts now clean into contact, and retain them so as they may grow to each other. Now when the two first requisites are performed, the

third may be easily obtained, as Celsus [c] very well observes, when he says, *Neque verendum est, ne purum corpus puro corpori junctum non coëat, adjectis quoque medicamentis ad id efficacibus; cum sæpe exulceratio digitorum, nisi magna cura prospeximus, sanescendo in unum eos jungat.* "Nor is it to be feared that one clean part "being joined to another, will not concrete if medi- "cines are also used which are efficacious for that "purpose; for we see that in ulcerations of the "fingers, if we do not take great care in their cure, "they are joined into one." The principal difficulty therefore consists in procuring a free exit to the confined matter, and in depurating the cavity of the sinus; for there are many cases in which this last is very difficult, and sometimes even impossible to attain. Thus I saw a fistula with a narrow orifice opening in the anterior part of the left breast, which descended by a winding passage behind the cartilage of the rib; nor was it possible by any art, to prevent the matter from stagnating in the bottom of this fistula, since the cartilage of the rib made a compression impracticable, and an opening of the fistula dangerous if not impossible. Celsus [d] indeed would have a part of the rib cut out in such a case, that no corrupt matter may be left behind; but I believe no one will readily cut out a portion of the rib in a living person, and afterwards pull it off from the pleura to which it firmly adheres. The patient now mentioned, had undergone all methods that could be tried, but without success, and was destroyed by the disorder which was unavoidable, dying in about two years after. Thus also when a fistula has extended to the bone and infected the same, the parts cannot be depurated before that portion of the bone is exfoliated naturally, or else removed by art. Such fistulas very often occur about the jaws, which often continue years, and give way to no re-

[c] Ibid. pag. 332.
[d] Lib. VII. cap. 4. n°. 2. pag. 412.

medies;

medies; but after a tooth has been drawn, even a ſound as well as a carious one, which by coming thro' the ſocket of the jaws, continually injured and irritated the adjacent ſoft parts, they are then often cured in a few days time. But for the cure of fiſtulæ the following methods are principally recommended.

To open them in their lower part by inciſion.] If the orifice of the ſinus or fiſtula is ſo placed that the humours contained in its cavity cannot diſcharge themſelves by their own weight, the cure is always difficult; for they will be accumulated and increaſe the preternatural cavity. Therefore ſkilful ſurgeons always endeavour to make a new opening in the lower part of the ſinus, that the matter, ſanies, *etc.* may diſcharge themſelves ſpontaneouſly. But if they are doubtful in what part the bottom of the ſinus or fiſtula is ſeated, they ſtop up the orifice with a tent for the ſpace of twenty-four hours, in ſuch a manner, that nothing can be diſcharged; and thus by confining humours, they make a tumour in the moſt depending part. The ſame thing is alſo performed by a prudent injection of warm water. By this method indeed the collecting humours are prevented from ſtagnating in the cavity of the ſinus or fiſtula, but then the whole internal ſurface very often remains foul, ſordid, or even callous, which therefore makes a depuration neceſſary.

By filling the cavity with liquefied digeſtives choſe according to the nature of the caſe.] In what manner ſordes of the like nature formed in wounds, are to be removed, has been ſaid in the commentaries on § 207. and the ſame remedies will be here proper either of a milder or more acrid nature, according as the ſordid parts are thicker, or the internal ſurface of the ſinus or fiſtula more or leſs callous. Now in an open wound it is very eaſy to apply theſe remedies to every point of their ſurface, but not ſo in a winding fiſtula. The antient phyſicians uſed collyria for this purpoſe, by which name we are to underſtand a ſort of cone or tent; for notwithſtanding that term is at preſent generally uſed to denote

thoſe remedies of the ſhops, which ſerve for the cure of diſeaſes in the eyes, yet it was uſed in a more ample ſenſe among the antients, for Gorræus[d] proves from the beſt authors, that κολλύριον is as much as to ſay a tail cut off (κολοβὴ ὄρα). Thus Celſus[e] alſo recommends a plaiſter for the cure of ſimple and recent fiſtulas in the fleſh, which was applied for recent wounds, provided it contains ſome ſalt, allom, verdigreaſe, or ruſt of braſs, *etc.* And he then adds: *Exque eo collyrium fieri debet altera parte tenuius, altera paulo plenius. Idque ea parte, qua tenuius eſt, antecedente demitti oportet in fiſtulam, donec purus ſanguis ſe oſtendat, etc.* "And of "this a collyrium ought to be formed ſmall at one end, "and a little larger at the other: and this is to be in- "troduced into the fiſtula with the ſmalleſt end fore- "moſt till clean blood ſhews itſelf," *etc.* The whole intention ſeems to have been by this method to apply ſuch medicines to every point of the internal ſurface of the ſinus or fiſtula, as might ſeparate the ſordes or conſume the callus there ſeated. The beſt method ſeems therefore to be not barely to add the aloes, myrrh, olibanum, verdigreaſe, *etc.* to the ſubſtance of a fat plaiſter, but rather to mix them with honey or the yolk of an egg, for then they may be diſſolved by the affluent humours, and act with more power on the parts to which they are applied, and as they are thus reduced to a fluid ſtate, they will be more equally diſtributed throughout the whole extent of the ſinus or fiſtula. Add to this, as collyria are required to have a ſolid form to convey them through the orifice to the bottom of the fiſtula, therefore if they do not gradually diſſolve or melt, they will contuſe or preſs the adjacent ſoft parts, like a foreign body, and by that means do more harm than good. For this purpoſe therefore let ſome balſam, for example, turpentine, be taken and mixt with an equal quantity of the yolk of an egg, and to theſe well incorporated add honey and other detergents according as the caſe may require; and of theſe let a

[d] Definit. Med. pag. 324, 325. [e] Lib. V. cap. 28. pag. 330.

hollow

hollow cone be formed of a ſolid conſiſtence like the ancient collyria, or rather a more fluid form of medicine, which melting with a gentle heat may fill up the whole cavity.

By the injection of deterſives.] It is very evident that the preceding method can take place only where the ſinus or fiſtula is ſimple and runs in a ſtrait courſe; but when the fiſtula takes a winding courſe, or as it were, divides into ſeveral branches, there is then occaſion for other means. For then we ought not to uſe collyria: as Celſus tells us[f], *Quod unam partem curet, reliqua omittat; ſed eadem medicamenta arida in calamum ſcriptorium conjicienda ſunt, iſque ori fiſtulæ aptandus; inſpirandumque, ut ea medicamenta intus compellantur. Aut eadem ex vino liquanda ſunt, vel, ſi ſordidior fiſtula eſt, ex mulſo; ſi calloſior, ex aceto; atque intus infundendum, quidquid inditum eſt.* "Which cure only one "part and omit the reſt, but we are alſo to throw in "dry medicines through a writing quill, adapted to "the mouth of the fiſtula, blowing through the quill "to drive in the medicines. Or elſe the ſame medi- "cines are to be diſſolved in wine, or in mead if the "fiſtula is fouler than uſual: but in vinegar if it is "more callous, and the things thus prepared, are to "be injected or poured into the cavity." All thoſe remedies therefore which ſerve occaſionally for the preparing of collyria being diluted in ſome convenient liquor, are uſually injected through the mouth of the fiſtula; and of this nature there are various forms of remedies to be found in the *Materia Medica* correſponding to this aphoriſm. But it muſt be obſerved, that theſe injections are often prejudicial, if they are urged in too violently, for then they may eaſily make new paſſages into the panniculus adipoſus, and by that means increaſe the diſorder; and beſides this, they are all ſerviceable only inaſmuch as they remove the ſordes, and conſume the calloſity of a fiſtula; but after the

[f] Ibidem. pag. 332.

parts have been once depurated, they will be rather injurious by preventing their union; for even the beſt balſams interpoſed betwixt wounded or divided parts, do like foreign bodies prevent them from healing and uniting. Therefore Celſus[h] adviſes us to uſe agglutinating medicines only, *Si ea tunica, quæ inter foramen et integram carnem eſt, vecta tot medicamentis exeat, infraque ulcus purum ſit:* "When that coat or ſkin "which is ſeated betwixt the opening and the ſound "fleſh, is ſeparated and diſcharged by the many re-"medies, and leaves the ulcer clean underneath." For then he orders the application of a ſponge dipped in boiled honey, and condemns the collyria; ſince there can be no danger of one clean part conjoining with another, as we obſerved a little before from the ſame author. But the whole internal ſurface may be known to be clean, if it diſcharges a white, ſmooth, and uniform matter without any ſanies or ichor, and without any fœtid ſmell. Thus for example, a tent or collyrium being introduced into a ſinus or fiſtula, as alſo the plaiſter or pledget covering its orifice, is diligently examined by the ſkilful ſurgeon when he renews the dreſſings, in order to perceive whether they are moiſtened in any part with a thin ſanies inſtead of laudable matter; for then they are aſſured that all the compaſs of the ſinus or fiſtula is not yet depurated.

By bandage preſſing gradually from the bottom towards the opening.] The beſt matter corrupts by ſtagnating, and degenerates into a thin and acrid ſanies, ſee the commentary on § 402. numb. 4. ſo that although the internal ſurface of the ſinus or fiſtula has been well cleanſed, new ſordes will be again formed, unleſs the ſtagnation and corruption of the matter can be prevented. But in order to effect this, an artificial compreſſure by bandage is of the greateſt efficacy, joined with ſuch a poſture of the part, as that the collected matter may paſs freely out through the orifice of the fiſtula, and not at all ſtagnate or be collected in its bottom. Thus we read in Galen[i], that a ſinus

[h] Ibidem. [i] Ibidem. which

which descended through the thigh and terminated at the knee, whose original orifice opened above the middle of the thigh, was cured, without making any counter opening, by fixing soft compresses or pillows under the ham, so as to raise it higher than the inguen. But the bandage ought to be such as by a gentle pressure may retain the clean parts in contact. Now as even in a clean wound of any moment, there is matter daily formed, it ought to be capable of a discharge; and therefore the sinus is not to be compressed by compresses and bandage all at once throughout its whole length, but by proceeding gradually from the bottom to its opening. Therefore the fundus or lowest part of the sinus is to be diligently sought for: but this may be discovered by a prudent injection of mead or the like deterging liquor, serving to depurate fistulas, if attention is at the same time given, how far and towards what part the liquor tends, which may be also known by beginning a gentle pressure upon the parts below, and continuing the same upwards so as to expel the matter contained in the sinus; for when the pressure made upon the adjacent parts has extended to the bottom of the sinus, the matter will then begin to flow out through its orifice. The part being thus discovered, in which the bottom of the sinus or fistula is seated, if the surgeon is assured that the whole internal surface of it is clean, he then applies a compress to that part, by which means it determines the pressure by his bandage, so as to reduce the clean parts at the bottom of the fistula into contact; the remainder of the sinus or fistula being only retained loosely with a spiral bandage, while the orifice remains open, to allow of a free discharge to the contained matter. Galen [h] has very well described this method, in treating of the various methods of curing sinuses, where he says: *Colligatio autem a fundo sinus quidem incipiat, finiatur autem in ejus orificio. Fasciarum vero circumductiones sine dolore fundum sinus premant, quæ paulatim*

[h] Method. Med. ad Glaucon. Lib. II. cap. 10. Charter. Tom. X. pag. 386.

usque

usque ad orificium (sinus) laxentur; "But the bandage is to begin at the bottom of the sinus and terminate at the orifice; but the circumvolutions of the bandage are to press so gently upon the bottom of the sinus, as not to give any pain, and are to be laid on more loosely by degrees, till they come to its orifice." He also observes that a plaister ought to be applied to the orifice, with an aperture cut in it by a pair of scissars, to give a discharge to the matter when there is any, *etc.* At the following dressings all the matter is to be gently pressed out before the compress is removed from the bottom of the sinus, to which it was applied, and after removing the compress, an attempt must be made to express what other matter is lodged in the adjacent parts; and if any quantity of matter is then discharged, it is a sign that the compress was not applied low enough, but that matter is as yet contained beneath it, and therefore it will be proper to alter its situation; but if no matter is then found to discharge itself, the compress is to be applied a little higher up towards the mouth of the sinus, ascending a little at each dressing, and with the like precautions; by which means a concretion of the separated parts, will begin in the bottom of the sinus, and proceed gradually towards its orifice. Hippocrates [k] expresses this matter with his usual brevity when he says, *Quæ abscesserunt, ut sublimia sint, naturalem sedem tangere quidem debent, non vero comprimi:* "For those parts to fill up which have been wasted, they ought to touch each other without being compressed," (for that this is the sense of this obscure passage, appears from the commentaries of Galen to this text.) "This contact is to begin in the sound parts, and terminate at the opening of the sinus, that what matter is confined may be depressed or milked out, and no more be collected." But the term milked out seems to be here very proper

[k] Hippocrat. de Medici Officina, Textu 27. Charter. Tom. XII. pag. 63.

to

to expreſs a gradual derivation of the matter from the bottom of the ſinus towards its opening made by a gentle preſſure in the ſame manner as the milk is forced out by a gentle preſſure continued from above downwards in the milking of a cow, while the orifices of the teats remain open. But the ſigns by which we know that the cure in this caſe ſucceeds, are very well enumerated by Galen [1] as follows, *An vero ſinus profundum pulchre conglutinatum fuerit, hæc tibi ſit diagnoſis ex ſanie effluente: ſi pauca vel multa ſit, cocta vel cruda. Præterea ſi circa ipſum ſinum neque dolor ſentiatur, neque tumor appareat, ſed totus locus æquabilis ſit, ſiccus, ac doloris expers. Quod ſi puris probe cocti pauculum in orificio, videris, multo magis de glutinando ſinu ſperandum eſt.* "But whether or no the bottom of the ſinus is well "conjoined, take your diagnoſis from the effluent "matter: according as that is either in a large or "ſmall quantity, and crude or concocted. As alſo "when there is no pain felt about the ſinus itſelf, nor "any tumour appears, but the whole part ſeems even, "dry and without pain. But if you ſhould ſee only "a ſmall quantity of pure concocted matter in the "orifice, there is ſtill more reaſon to hope for the "agglutination of the ſinus." But though this method may ſucceed very well in many inſtances, yet it is evident enough that it cannot take place, unleſs the whole ſurface of the ſinus or fiſtula is very clean, and acted upon by an external preſſure. Therefore when a fiſtula ariſes from an injury of the ſubjacent bone, or has not been firſt well depurated of its calloſity, or if it runs in ſuch a manner that an external preſſure cannot reach to its bottom, the only method that then remains, is to lay open the integuments by inciſion, that ſuitable medicines may be applied to the whole ſurface of the fiſtula.

[1] Galen. Method. Med. ad Glaucon. Lib. II. cap. 10. Charter. Tom. X. pag. 386.

But

But the integuments are the ſooneſt divided by inciſion upon a grooved probe or director.] The moſt expeditious method of curing a fiſtula or ſinus, is to convert it into an open ulcer, by dividing the integuments; for the difficulty of the cure does not ariſe ſo much from the internal calloſity, as from the matter which there ſtagnates and corrupts. It appears from the moſt faithful obſervations, and from many caſes of this nature, which I myſelf have ſeen, that fiſtulæ have been cured within the ſpace of fourteen days, barely by inciſion, when other methods have been tried in vain for many months or even years. Celſus [m] being well acquainted with this matter, therefore pronounces, *Adverſus fiſtulas quoque, ſi altius penetrant, ut ad ultima demitti collyrium non poſſit, ſi tortuoſæ ſunt, ſi multiplices, majus in manu, quam in medicamentis præſidium eſt; minuſque operæ eſt, ſi ſub cute tranſverſæ feruntur, quam ſi recta intus tendunt. Igitur, ſi ſub cute tranſverſa fiſtula eſt, demitti ſpecillum debet, ſupraque id ea incidi. Si flexus reperiuntur, hi quoque ſimul ſpecillo et ferro perſequendi ſunt. Idemque faciendum, ſi plures ſe quaſi rivuli oſtendunt.* "But for the cure of thoſe "fiſtulæ which penetrate ſo very deep or run ſo winding, or branched out, that a collyrium cannot be "conveyed to the bottom, the cure is then to be rather "expected from manual operation than the uſe of medicines; and the cure will be ſtill more expeditious "by the operation, if the fiſtula runs tranſverſely under the ſkin, than if it tends directly inwards. "Therefore in a tranſverſe ſubcutaneous fiſtula, a probe "or director is to be introduced, upon which it is to "be laid open by inciſion. If any turnings are found "in the fiſtula, theſe are alſo to be followed and laid "open by the knife or director. The ſame is to be "alſo done, when the fiſtula appears to divide itſelf as "it were into ſeveral branches." There are indeed many boaſted remedies or arcana for the cure of ſtubborn

[m] Lib. VII. cap. 4. nº. 1. pag. 412.

fiſtulæ

fistulæ without cutting, but how little we ought to confide in them, appears from the instance of the late French king Lewis XIV. who being disordered with a fistula in ano, had an infinite number of remedies proposed to him, the principal of which were made trial of by the king's order, upon patients afflicted with the same disease, but all without effect: and though a whole year was spent in these trials, the king at length submitted to, and resolutely underwent, the operation, even though the surgeon [n] was obliged to lay open all the branches of the fistula by many incisions. But that this incision may be safely performed without injuring the adjacent parts, surgeons have contrived various methods. For when the fistula runs immediately under the integuments, it may be then sufficient to introduce a director carefully through the orifice of the fistula down to its bottom; and then to make an incision by guiding the knife or razor along the groove of the director, so as to cut through all the parts which are intercepted betwixt them. But when the course of a fistula tends more inwards, as it very frequently does when seated in the anus, in that case it is customary sometimes to use,

A silver wire.] Formed of the purest silver heated red hot, and suffered gradually to cool, to render it the more pliable, and being also furnished with an obtuse end like a probe, which is conveyed through the opening of the fistula, entering it by degrees till it has reached the bottom, and one may perceive the obtuse end under the integuments: then an incision being made in that part, the wire is drawn through and the two ends of it are then drawn up, so as to remove the integuments from the subjacent parts, that they may be safely divided either by the scalpel or sciffors.

This was the method formerly used for the curing of fistulæ in the anus by incision, for they introduced

[n] Dionis Cours d'Operations de Chirurgie, Demonstrat. 4to. pag. 228, etc.

such

ſuch a probe through the external orifice of the fiſtula, until the ſurgeon could perceive the extremity of it coming into the anus by introducing his forefinger up to the internal orifice of the fiſtula, or if there was no entring an orifice, they boldly perforated the inteſtine with the end of the probe. They then bent the end of the probe with their forefinger, and brought it out through the anus, ſo that by pulling the two ends of the wire, they extended the parts which were to be divided, that is not only the common integuments, but alſo of the ſphincter ani, and part of the inteſtinum rectum were to be divided in this caſe [o]. Hippocrates [p] has ſtill another method of curing fiſtulæ of the anus: He orders a probe of tin, the eye of which is to be armed with five threads, circumvolved and tied together with a horſe-hair, which is to be conveyed through the orifice of the fiſtula; then the forefinger of the left-hand being introduced into the anus, the end of the probe is to be bent and brought outward, until the thread follows. After the probe is extracted, he orders the two ends of the ligature to be tied in a knot, and the patient to be then diſmiſſed, that he may go about his affairs like other people who are well. His intention is ſo to extenuate all the integuments by degrees with a ligature, that they may be at length quite cut through: whence Hippocrates obſerves, that the ligature is to be tightned every day by twiſting in proportion as it becomes looſer, by cutting through the fiſtula; and if the ligature ſhould ſeem to be corrupted, a freſh one is to be introduced by tying it to the end of the former, which is to be then extracted, and the new ligature tightned as before. Celſus [q] very juſtly calls this a very tedious method of cure; but whether it is without pain, as he alſo aſſerts, I very much doubt: For he ſays, *Paulatim cutem, quæ ſupra fiſtulam eſt, incidit, ſimulque et id ſaneſcit, quod a lino relictum eſt, et id,*

[o] Ibid. pag. 285 [p] De Fiſtulis, cap. 3. Charter. Tom. XII. pag. 142. [q] Lib. VII. cap. 5. n°. 4. pag. 414.

quod

quod ab eo mordetur, inciditur. "That the ligature "gradually divides the skin which is above the fistula, "while in the mean time those parts heal, which have "been left behind the ligature, and those are divided "which are thereby constringed." For when by the motion of these parts in walking, the ligature is rubbed against the sides of the fistula, it must give no small uneasiness; but if the sides of the fistula are so callous as not to receive any pain from that attrition, then that method will not easily divide the integuments, but after a tedious delay recourse must be had to the knife itself. But that the preceding method had been often used without success, is evident from what follows a little after in the same place of Hippocrates. For he says: *Si vero fistula non fuerit exesa, demittens specillum incide, quo usque illud pervenerit, et insperge æris florem, et per quinque dies relinque, etc.* "But "if the fistula should not be thus cut through, in-"troduce a probe and lay it open as far as it penetrates "by incision, after which make an aspersion of flores "æris, and thus leave it for five days," *etc.* Celsus observes in the place lately cited, that those who are in haste to have the integuments divided, ought to tighten the ligature: and he likewise observes, that the same division will be hastened by spreading the ligature with medicines which corrode callous parts, but then the pain will be greater; and at last he adds, that it may be also done by the scalpel, the use of which will perhaps be necessary after all, *etc.* He seems therefore to undervalue this method by ligature, as it makes no discharge or separation of the foul parts, and often occasions much pain and uneasiness to the patient, as well as trouble to the surgeon.

Syringotomus.] This instrument is so called from its use in cutting fistulæ, and there are various forms of it described by authors. It is most commonly recommended for the cure of fistulæ of the anus. The

[f] De Fistulis, cap. 4. pag. 143.

instrument

inſtrument is compoſed of a probe joined to a ſcalpel or razor, ſo that by introducing the former through the fiſtula, a diviſion is then made by the latter, and thus one inſtrument performs what was to be done by two. But the ſyringotomi which are repreſented to us by Scultetus, Van Solingen, Fabricius ab Aquapendente and others, ſeem to be leſs commodious for this purpoſe, and eſpecially for dividing fiſtulæ of the anus. For here a falciform knife terminates in a probe made of the ſame metal, ſo that this laſt part of the inſtrument has not the pliability which is required to bend the probe by the finger in the cavity of the inteſtine, ſo as to draw it outwards. But the induſtry of modern ſurgeons has corrected the defects of this inſtrument[s], for they unite a probe of pure flexible ſilver to a crooked knife made of the beſt ſteel, while part of the inſtrument is concealed in a crooked handle; but it may be ſeen repreſented by a figure in the end of this book.

The fiſtula being thus divided, is changed into an open ulcer, and if then it appears to have many branches, each of them are to be divided after the like manner, that there may be no lurking places for the matter to conceal itſelf in, ſo as to ſtagnate and corrupt. But as the internal ſurface of the fiſtula is in this caſe frequently found callous, therefore ſurgeons uſually make ſcarifications in ſeveral places, that the calloſity may be the ſooner removed by the application of digeſtives or corroſives. Even Celſus[t] would have the whole callus to be cut out, after the fiſtula has been laid open to its bottom. But every thing which has been ſaid in the commentary on § 411. is alſo to be obſerved in this place.

[s] Garengeot. Traité des Inſtrumens de Chirurgie, Tom. I. cap. IX. pag. 286.

[t] Lib. VII. cap. 4. pag. 412.

SECT.

SECT. CCCCXVI.

FROM what has been said, we may derive a knowledge of the nature, consequences, and methods of treating buboes, parotides, furuncles, or boils, anthraces, carbuncles, phymata, erysipelata, the measles, small-pox, purple spots, and the like.

From all that has been hitherto said in the history of inflammation, and suppuration thence following, we may derive a knowledge of a great many disorders, which may be referred to inflammation, and its consequence as the cause, notwithstanding they are distinguished by peculiar names in common practice. And at the same time also we may be able to deduce their prognosis and method of treatment from the same knowledge. The principal of these disorders are those here enumerated, such as

Buboes.] The Greek physicians denominate the groins (βουβῶνες) *bubones*, and they likewise denominated the glands there seated, by the same name; nor did they alter the name, even when the like tumour was observed in the glands of the axilla. We even read in Galen [a] of tumours formed in other glandular parts of the body, called by the same name: for he says, *Quinetiam in collo et secus aures sæpe glandulæ intumescunt, natis ulceribus circa caput, collum, vel aliquam ex vicinis partibus. Nominant autem sic intumescentes glandulas bubones:* "Also the glands which are "seated in the neck and behind the ears, very often "tumify, and are accompanied with an ulcer about "the head, neck, or some of the other adjacent "parts: but the glands thus tumified are denominated buboes." But at present it is customary with

[a] Method. Med. Lib. XIII. Charter. Tom. X. pag. 297.

us only to call tumours of the groins and arm-pits by this name. Now these buboes are either inflammatory, suppurating, or scirrhous, all arising from the common causes of inflammation. But there are also buboes which frequently arise in the worst contagious diseases, as in the plague; and sometimes also in the venereal disease, in which last the inflammation is not very sudden or violent, but usually continues a long time before it can be resolved, or else be brought to a laudable suppuration, frequently resisting even the most efficacious remedies. Sometimes also, there is a translation or settlement (ἀπόστασις vel μετάστασις) of the morbific matter with very good success upon these parts, which is then termed a metastasis or apostasis. And even sometimes in men who are healthy in other respects, these tumours suddenly arise without any topical cause, producing first an inflammation, and then a suppuration: and these are the latent efforts of nature, by which she separates those humours from the whole mass of blood, which might prove of worse consequence, without giving any manifest signs of the latent nature of the disease. Hence it is that these parts were esteemed by the antient physicians as the emunctories or drains of the viscera; and Galen says [b] that the glands very easily receive an afflux of the humours, by reason of their weakness and spungy texture. Now if we consider the situation of the inguinal and subaxillary glands, they will appear to be well adapted to receive those humours, which ought to be discharged from the whole habit: for they are placed in the very soft adipose membrane, almost free from all muscular compression, having very large arteries, veins and nervous trunks, near them, from which they receive their branches. But these glands have so great a commerce or consent with the other branches of these nerves, that when they are injured, these glands are often immediately inflamed and swelled. Thus I have frequently seen a very

[b] Ibid. pag. 296.

painful paronychia produce a ſudden tumour in the axilla, even though the diſorder was ſeated in the end of the finger. When a woman unfortunately run a needle up under her nail, ſo as to injure the nervous ſubſtance which is there ſeated with the moſt acute pain, I was ſurprized to find that in a quarter of an hour after there was a conſiderable tumour in the arm-pit of the ſame ſide. From hence the reaſon is evident why Hippocrates [c] ſays, *Febres poſt bubones ortæ, niſi ephemeræ fuerint, malum.* "Fevers ariſing "after buboes, are bad, unleſs they are (ephemera's) "but of a days continuance." For he here intends that the fever denotes a fruitleſs attempt of nature to expel the morbific matter by abſceſs. And therefore fevers ariſing from ſuch a latent cauſe muſt be very ſtubborn, unleſs they are ephemera's, which run thro' their courſe, or terminate within twenty-four hours, and ſignify the ſtrength of nature overpowering the diſeaſe. And in another place he ſays, *bubones febribus ſuccedentes deteriores, ſi in acutis ab initio decreſcant.* "That buboes ariſing after fevers are bad if they "decreaſe from the beginning in acute diſtempers." For theſe then denote an inſufficient endeavour of nature, and in dangerous fevers muſt be always bad: For buboes ſeldom appear in fevers, unleſs they are very acute. I remember myſelf to have ſeen buboes in the worſt ſpecies of the ſmall-pox, and in the plague; all who have wrote upon that diſtemper teſtify that they are very frequent.

Parotides.] This name denotes a tumour of the glands behind the ears, which is called parotis by the Greeks, which is as much as to ſay, an abſceſs behind or under the ear. They are alſo by Hippocrates often called τὰ παρ' ἕς ἐπάρματα, *vel ſimpliciter* τὰ παρ' ἕς. What has been ſaid concerning the inguinal and ſubaxillary glands, as being ſeated in the ſoft fat, and freed

[c] Epidem Lib. II. Charter. Tom. IX. pag. 162. & Aphor. 55, Sect. 4. ibidem pag. 170.

from the compreſſure of muſcles, *etc.* The ſame is alſo true concerning the parotides; for they occupy that cavity which we find at the root of the ear betwixt the maſtoide proceſs of the ſkull, and the condyloide head of the lower jaw, from whence they are extended downward and backward under the lobe of the external ear. They likewiſe receive large branches from the adjacent external carotid artery. The tumours of theſe glands appear much more frequently in diſeaſes than buboes, and Hippocrates from thence deduces part of his prognoſis in many diſtempers, as will hereafter appear. But it may be ſufficient for us at preſent only to remark from Celſus [d], *Sub ipſis vero auribus oriri παρωτίδες ſolent, modo in ſecundo valetudine, ibidem inflammatione orta; modo poſt longas febres, illuc impetu morbi converſo. Id abſceſſus genus eſt. Itaque nullam novam curationem deſiderat: animadverſionem tantummodo hanc habet neceſſariam, ut, ſi ſine morbo id intumuit, primum reprimentibus fiat: ſi ex adverſa valetudine, illud inimicum eſt, maturarique et quam primum aperiri commodius eſt.* "But under the ears "themſelves the parotides uſually ariſe, as well in an "ill ſtate of health, or after an inflammation in them; "as after long fevers when the violence of the diſeaſe "tends to that part. This is a kind of abſceſs, and "therefore does not require any different method of "treatment; only this caution is neceſſary to be ob- "ſerved, that if they ſwell without a diſeaſe, trial "ought firſt to be made with repelling medicines; "but if they ariſe from an ill ſtate of health, it is from "ſomething offenſive to nature, whence it will be "more convenient to maturate and open it as ſoon as "poſſible."

Furuncle or boile.] This is a very painful inflammatory tumour, ſeated in the external ſurface of the body, and ſlowly tending to ſuppuration, appearing very red, and when once the abſceſs is opened, there generally appears concreted blood in the bottom,

[d] Lib. VI. cap. 16. pag. 391, 392.

whence it is usually denominated a *bleeding-ulcer*. These kinds of abscesses sometimes prove epidemical, and not only invade many men in the same country, but also people of different countries, and appear in different parts of the body. Celsus [e] gives us the following description of a furuncle: *Furunculus vero est tuberculum acutum cum inflammatione, et dolore; maximeque ubi jam in pus vergit. Qui ubi adapertus est, et exiit pus, subter apparet pars carnis in pus versa, pars corrupta subalbida, subrubra; quem ventriculum quidam furunculi nominant. In eo nullum periculum est, etiamsi nulla curatio adhibuatur: maturescit enim per se atque erumpit. Sed dolor efficit, ut potior medicina sit, quæ maturius liberet.* "But a furuncle is a sharp pointed tumour with inflammation "and pain, which are the most violent when it is about "turning to suppuration. When this is opened and "the matter discharged, there appears underneath, "part of the flesh turned to matter, part of it cor"rupted and of a whitish colour, and part of it a red"dish colour, which part is denominated the ventricle "or stomach of the boil. There is no danger in "this tumour, even though no care be taken of it, "for it both ripens and breaks out of itself; but it "occasions a pain, and therefore it may be proper to "use medicines which soon maturate or free it from "the pain." As a mild resolution can never be expected in a furuncle, the whole intention of the cure consists in bringing it as soon as possible to suppuration; and because these tumours are generally difficult to bring to a perfect maturation, therefore it is usual to add such things to emollient applications, as are capable of exciting a little greater motion in the part to be suppurated: whence Celsus [f] pronounces *proprium furunculi medicamentum galbanum est*; "that gal"banum is a medicine proper to a furuncle."

[e] Lib. V. cap. 28. nº 8. pag. 324.
[f] Ibidem.

Anthraces.] When the external skin and subjacent panniculus adiposus, are suddenly corrupted by a violent inflammation, so as to form a dry hard scab or eschar, which being perfectly dead, ought to be separated from the living parts by suppuration, that inflammation is then usually called anthrax or a burning coal. The writers of observations testify, that this is a frequent disorder in the plague, especially when the fury of the disease is mitigated and the latent virus derived to some particular part of the body by victorious nature. But there are two kinds of anthraces described by Galen [g], where he treats of the different kinds of inflammation, *Quando influens sanguis admodum calidus fuerit, et crassus in quamcumque partem confestim fluxerit, illam adurit, ulcusque crustam habens efficit. Quidquid autem circumstat, in ferventem inflammationem attollit, et valide dolentem. Vocatur autem ille affectus anthrax. Quod si influens sanguis niger sit, crassus, fæculentus, ac fervidus, qualis est prior, admixtamque quandam saniem habeat tenuem, pustulas in superficie cutis excitat, similes his, quæ ab igne fiunt: quibus ruptis sub ipsis crustosum ulcus invenitur. Est autem hic affectus etiam anthrax.* "When the influent blood is "very hot and thick, flowing very rapidly into a "part, it burns up the skin, and forms an ulcer with "a crust or scab: But all the circumjacent parts it "raises into a hot inflammation, which is extremely "painful. But this disorder is termed anthrax; but if "the influent blood is black, thick, feculent, and "very hot like the former, being also mixt with "a kind of thin sanies, it causes pustules in the sur-"face of the skin, like those which are raised by "fire; which being ruptured, an ulcer is perceived "under the crust. But this last disorder is also an "anthrax." The first species of an anthrax is most agreeable to the common sort, but the definition given

[g] Method. med. ad Glaucon. Lib. II. cap. 1. Charter. Tom. X. pag. 269.

of

of the latter kind, denotes a milder ſpecies of the ſame diſorder. The cure conſiſts in procuring a ſuppuration all round the anthrax, ſo as preſently to ſeparate it from the adjacent living veſſels; for the ſubſtance of the anthrax itſelf can never be converted into matter. The moſt emollient remedies only are therefore proper in this caſe.

Carbuncle.] This is related to the anthrax, but ſomewhat milder. The modern ſurgeons generally call by this name an ulceration of the ſkin in ſeveral parts, following after a very violent and painful inflammation, in which there is alſo ſome fragments of the panniculus adipoſus diſcharged from the ulcerations. But the diſorder which Celſus [h] deſcribes by this name, ſeems to have been different from theſe carbuncles: for he ſays, *rubor eſt, ſuperque eum non nimium puſtulæ eminent, maxime nigræ, interdum ſublividæ, aut pallidæ. In iis ſanies eſſe videtur; infra color niger eſt. Ipſum corpus aridum et durius quam naturaliter oportet. Circaque quaſi cruſta eſt; æque inflammatione cingitur. Neque in eo loco levari cutis poteſt, ſed inferiori carni quaſi affixa eſt. Somnus urget. Nonnunquam horror, aut febris oritur, aut utrumque. Idque vitium ſubteractis quaſi quibuſdam radicibus ſerpit interdum celerius, interdum tardius* "That it is red, having "puſtules ariſing upon the ſurface not very high, ge- "nerally black, but ſometimes livid or pale, in "which there ſeems to be a ſanies, and underneath "there is a black colour. The body itſelf appears "drier and harder than it naturally ought, and about "the edge there is a ſort of cruſt circumveſted with "an inflammation. Nor can the ſkin be taken off in "that part, but it ſeems as it were faſtned to the fleſh "beneath, the patient is ſleepy, and ſometimes taken "with a ſhivering or a fever, or both. When the "diſorder is once fixed, it ſpreads as it were with "roots ſometimes faſter and ſometimes ſlower." The

[h] A Corn. Celſ. Med. Lib. V. cap. 28. nº 1. pag. 315, 316.

The cure which he afterwards subjoins, sufficiently proves that these carbuncles were malignant, and perfectly destroyed or mortified the part which they invaded. For he immediately orders them to be cauterized, which he adds, may be done without pain, because that flesh is dead; and he orders the cauterization to be continued until every part is sensible of the pain. But how dangerous these carbuncles sometimes were, is also evident from Celsus in the same place, who says that if this disorder is seated in the stomach or fauces, it often suddenly strangles the patient.

Phymata.] Galen [i] will have phymata derived from sprouting (ἀπὸ τῦ φύεσθαι) for he says: *Ab iis, quæ ex terra progerminant, homines phymata vocaverunt tumores præter naturam, qui omnino sine causa externa proveniunt: sed potissimum sic nominant eos, qui ad externum locum impelluntur. Quia autem aliud nomen non habetur, etiam latos, et paulo naturalibus partibus elatiores (tumores) eodem nomine appellant.* "That physicians have called phymata those preternatural tumours which arise without any external cause, like "things which grow out of the earth: but they "chiefly call those tumours by this name which are "seated externally. But for want of another name "they have thus called even broad tumours seated "prominent in the natural organs." From hence the use of this term seems to have been a little uncertain, and that even buboes and other suppurations of the glands, were sometimes thus called, is evident from another passage in Galen [k], where he says: *Imprimis autem quadam phymata appellantur inflammationes nonnullæ spontaneæ, subitissime natæ, citissime in acutum apicem elatæ et celerrime suppurandæ. Et plurima illorum generatio est in inguinibus et axillis, quod in his locis plures sint glandulæ, quæ hanc naturam habent,*

[i] Comment. 1. in VI. Epidem. Hipp. Textu. 13. Charter. Tom. IX. pag. 375.

[k] Commentar. in Aphor. 26. Sect. 3. Charter. Tom. IX. pag. 122.

ut

ut excrementa promptissime in se recipiant. "But there "are more especially some spontaneous and sudden "inflammations which are called phymata, which very "soon elevate the skin into a sharp tumour speedily "tending to suppuration. Many of them are formed "in the groins and arm-pits, because in these parts "there are many glands, whose office is readily to re-"ceive the excrements of the blood into themselves." Even Hippocrates [l] terms abscesses which arise after long fevers about the joints by the name of phymata; and in another place he calls by that name a tumour in the urethra [m] itself tending to suppuration; and in another place [n] he so calls a vomica broke inwards. This passage of Hippocrates is thus expressed by Celsus [o], *Quibus in fistula urinæ minuti absessus, quos φύματα Græci vocant, esse cœperant, iis, ubi pus ea parte profluxit, sanitas redditur.* "In those who have abscesses "seated in the urethra, which the Greeks call phy-"mata, when they discharge matter, they begin to "recover their health." The same author in another place [p] uses the name phymata barely to denote incipient tumours. But where he treats of the different kinds of abscesses [q], he gives the following more large description of a phyma, when he says, *Phyma vero nominatur tuberculum furunculo simile, sed rotundius et planius, sæpe etiam majus. Nam furunculus ovi dimidii magnitudinem raro explet, nunquam excedit. Phyma etiam latius patere consuevit: sed inflammatio dolorque sub eo minores sunt. Ubi divulsum est, pus eodem modo apparet: ventriculus, qui in furunculo, non invenitur: verum omnis corrupta caro in pus vertitur. Id autem in pueris et sæpius nascitur, et facilius tollitur: in juvenibus rarius oritur, et difficilius curatur. Ubi ætas induravit, ne nascitur quidem:* "But a phyma is a small tu-

[l] Aphor. 44, & 45. Sect. 4. Charter. Tom. IX. pag. 163.
[m] Aphor. 8. Sect 7. ibid. pag. 295.
[n] Aphor. 82. Sect. 4. ibid. pag. 191.
[o] A. Corn. Cels. Medic. Lib. II. cap. 8. pag. 70.
[p] Idem, Lib. V. cap. 18. n° 16. pag. 254.
[q] Ibid. cap. 28. n° 9. pag. 325.

"mour

"mour like a boil, but rounder and broader, and "frequently larger. For a furuncle seldom arrives to "half the size of an egg, and never exceeds it. A "phyma also spreads itself usually broader, but then "it has less pain and inflammation. When it is "opened there is also a matter found in it, but the "ventricle is not found here as in a furuncle, but all "the corrupted flesh is changed into matter. It arises "more frequently in children, and is in them more "easily removed; in young people it happens more "rarely, and is more difficultly cured, but it does "not appear at all when age is far advanced."

From all which it is evident that an inflammatory tumour speedily tending to suppuration, was generally termed a phyma, the knowledge and cure of which is therefore to be deduced from the history of inflammation and abscess.

Erysipelas.] Concerning this, see what has been said in the commentaries on § 380.

Measles] If we consider the account given us by Sydenham, who has the most accurately described the course of the measles from the beginning to the end, it will evidently appear that after a preceding fever, there are small inflammatory eruptions, which arise in the external skin of the face, about the fourth day usually in the regular kind, but sooner or later in those which are irregular, which pustules cohering in clusters, form red spots; and after this the trunk and limbs of the body begin to look red. At length on the eighth or ninth day all this redness again disappears and the broken cuticle appears white and rough upon the surface of the body, almost as if it was sprinkled with flour, and the cuticle falls off in little scales. From whence it is evident that the measles come near to the nature of an erysipelas, since they only occupy the external integuments, or the internal membranous parts of the body, and that they are never followed with a suppuration, but always disappear with a scaling off of the cuticle.

Small-

Small-pox.] Theſe are not eryſipelatous eruptions, like thoſe of the meaſles, but true inflammatory puſtules, tending to a mild ſuppuration, when they are of a mild and good kind, or elſe to a gangrene, when they are of the worſt kind. They not only invade the external ſurface of the body, but have been ſometimes obſerved likewiſe in the internal parts of the mouth, fauces, ſtomach and viſcera, as we ſhall declare more at large when we come to treat profeſſedly of this diſtemper. It is ſufficient at preſent for us to obſerve, that they are attended with all the true appearances of an inflammation, ending either in an abſceſs or a gangrene, and that the general rules which have been given for the cure of an inflammation and abſceſs, with that of a gangrene following do alſo take place equally in the ſmall-pox.

Purple or red ſpots.] By this denomination are called all thoſe cutaneous exanthemata or efflorescences which are ſometimes obſerved after another diſtemper, and are frequently not attended with any injury of the functions; nor can they therefore be well ranked amongſt the other diſorders of this aphoriſm. But of theſe we ſhall treat hereafter among the ſymptoms of fevers on § 723. and the following; and it will there appear that the knowledge and cure of theſe may be deduced from the hiſtory of inflammation.

SECT. CCCCXVII.

NOR will it be difficult to deduce a knowledge from hence, concerning the event of an internal ſuppuration, in which no acceſs can be given to the hand nor to other proper remedies, for many and great diſorders (§ 406, 413.) with collections of matter in the cavities of the body, thence follow.

From

From all that has been hitherto ſaid concerning abſceſſes and fiſtulæ, it is very evident, how difficult it muſt often be to cure internal ſuppurations, to which neither the eye can penetrate nor the hand reach. For the curative indications § 402. are equally neceſſary in the internal ſuppurations as external ones. But it is often impoſſible, or at leaſt extremely difficult to perform what is called for by the indications, for neither can the crude humours be maturated or concocted, nor the adjacent parts be mollified or relaxed, by the uſe of ſoftening cataplaſms and fomentations, ſince there is no acceſs given to the hand. It is alſo frequently quite impoſſible to derive the ſuppurating matter outward in theſe caſes, ſo as to diſcharge it in the form of a laudable matter by an opening with a lancet; but being therefore corrupted and attenuated by heat and ſtagnation, it corrodes the adjacent parts, or elſe being abſorbed by the patulent orifices of the veins, it infects the blood with a purulent cacochymia, whence follow all the diſorders mentioned at § 406. But matter contained in an internal abſceſs being daily increaſed, will by its weight make new ſinuſes and paſſages, if it is not abſorbed by the veins, till at length making a way through the internal membranes of the thorax or abdomen, it produces an empyema or a purulent aſcites. And as the matter becomes more acrimonious and increaſed in quantity daily, it will corrupt the viſcera, and deſtroy the patient with a ſlow maraſmus attended with the greateſt miſeries.

SECT. CCCCXVIII.

IF again the neceſſity or office of the affected part towards life and health be conſidered, the difficulty of the cure and the future conſequence may be eaſily foreſeen.

If

If we know what internal part of the body is injured by the suppuration, we may determine from physiology, what maladies are to be thence expected, and the more or less difficulty which will be met with in the cure. Thus for example, if the liver is suppurated, much danger from thence may be justly expected, since that is a viscus absolutely necessary to life and health, as the formation of bile which is so necessary to chylification is produced by that viscus. Therefore a jaundice, cachexy, dropsy, and many other disorders are to be feared; besides the substance of the liver is so friable and tender, that almost every part of it may by degrees be dissolved by the long confined acrid matter, whence a tabes hepatica, and a putrid colliquative flux follows, which soon destroy the patient. But if such an abscess should open and discharge its matter into the cavity of the abdomen, it will produce a purulent ascites, with the same pernicious effects. The open ulcer in the liver will then daily generate more matter, and all the viscera of the abdomen will be macerated in the same matter and corrupted in a short time. But if by good luck the matter contained in the abscess of the liver should make its way through the integuments of the abdomen outwards, even then the event will be doubtful. For if pure white matter is discharged the patient may recover; but if foul sordes appear, the patient will certainly perish, as Hippocrates [q] observes. Therefore the hopes are dubious in such a case, though it is not absolutely desperate. But if an inflammation arising in the encephalon turns to a suppuration, and no vent is given to the matter, then it will be impossible to avoid a destruction of the tender fibres of these parts, which are absolutely necessary to life; and therefore there can be little hopes in such a case. There are indeed some rare histories of wounds in the head which demonstrate

[q] In Coacis prænot. nº 451. & Aphor. 45. Sect. 7.

that

that matter, ichor, blood, *etc.* have been diſcharged by ways not well known from anatomy, out of the cavity of the cranium, and the patient has by that means eſcaped a deſperate caſe; but perhaps there is not one in a hundred who thus eſcapes. If again the vital viſcera contained in the cavity of the thorax, the heart and lungs, are invaded with an abſceſs, it is ſufficiently evident what fatal events are to be feared.

The End of VOL. III.

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